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ANNALS *of* SURGERY

Vol. 99 MAY, 1934 No. 5

LIGATION OF THE GREAT VESSELS OF THE NECK*

By George M. Dorrance, M.D.†

of Philadelphia, Pa.

The latter years of the eighteenth century and the beginning years of the nineteenth witnessed the first ligations of the carotid arteries of the neck. It is for approximately 150 years, therefore, that these ligations have been practiced.

Probably every surgeon who practiced in the nineteenth century, and almost certainly every living surgeon today has performed or has had personal contact with the surgery of these vessels. In spite of such widespread knowledge and tremendous total experience, the question of whether to ligate the common carotid or internal carotid primarily when a choice is presented remains a source of controversy whenever mentioned. Such controversy has its origin, of course, in the cerebral complications which so frequently follow the obliteration of either one of the main vessels.

At the moment of ligation or immediately thereafter, the patient may experience a sense of fainting combined with nausea and vomiting, cold sweat, ringing in the ears, and darkening of the fields of vision. These symptoms may be of a few seconds' duration only, or may be associated with homolateral headache, aphasia, partial or complete contralateral hemiplegia with anæsthesia and paræsthesia, and persist for days or weeks. The majority of these symptoms have a tendency toward improvement and usually completely disappear after a longer or shorter period of time. Too numerous are the patients, however, who develop permanent hemiplegia, with or without aphasia, blindness and mental deterioration. Too frequent also are the cases where the above symptoms precede by a few minutes only a deepening and slowing of respiration, generalized convulsions and death. If none of these signs or symptoms complicates the operation itself, the surgeon must still face an uncertain period of from several days to a week or ten days during which the signs of severe cerebral disturbance may suddenly occur, with hemiplegia or with death closing the scene.

Five theories are championed in interpretation of these cerebral disturbances.

First, anæmia due to failure of collateral circulation chiefly because of anomalies of the circle of Willis. Second, thrombosis and embolism. Third,

* 1933 Annual oration read before The Philadelphia Academy of Surgery.

† The author wishes to acknowledge the assistance of Dr. Paul Loudenslager, in the preparation of the statistical matter contained in this paper.

ischæmia—vasoconstriction due to sympathetic irritation. Fourth, circulatory stasis. Fifth, intracerebral hæmorrhage.

I have added a sixth thought, "cerebral injury independent of ligation," because it must be recognized, as Ramsay Hunt[32] reminds us, that "not all cerebral complications can be attributed to the ligation itself inasmuch as sepsis, meningitis, *etc.*, must be considered." Cerebral injury may, and often does, complicate the head injury or intracranial lesion which dictated the occlusion of the carotid vessel.

The fifth theory may also be admitted without discussion. Herman Pearse[56] suggests "might not these cerebral symptoms be due to increased arterial pressure inasmuch as they come on suddenly after ligation and are most apt to occur in a subject past middle life whose cerebral vessels are subject to rupture? It is significant that aneurisms and hemiplegia are manifestations of the same vascular disease." The occasional cerebral complication may be due to vascular rupture.

Under the first theory, the term "brain anæmia" conveys the idea that the total amount of blood supplied to the brain in a given unit of time has been reduced to a point where nutritional want or death of the cerebral tissue occurs. Insufficiency of the collateral circulation, chiefly because of anomalies in the circle of Willis, is generally held responsible for this diminished volume flow.

The thrombosis and embolism theories would explain that cerebral complications result when a preformed thrombus, or a clot which is the result of operative manipulation, is loosened and swept into the cerebral vessels. Complications occurring after an interval of days are supposed to result from thrombosis arising at the point of ligation and advancing by progressive coagulation into the intracranial channels. LeFort[41] believes all the late effects to be due to thrombosis from the site of ligation, advancing, in the case of common carotid ligations, to the bifurcation of the common carotid, where the recurrent flow from the external carotid may sweep away an embolus.

Under the concept of sympathetic irritation, there is visualized a homolateral ischæmia of the brain, as the result of tonic vasomotor spasm of the cerebral vessels, induced by irritation of the sympathetic nerve filaments in the neck. In the words of Weiting,[70] "a spastic contraction of the arteries at the base of the brain impedes for a time the formation of collateral circulation."

The least discussed theory explains cerebral symptoms on the basis of a circulatory stasis. The exact mechanism by which stagnation is produced is not uniformly described. Friedlander[24] maintains that with one channel of blood supply cut off, there occurs an imbalance of the hydrodynamic equilibrium of the circle of Willis, with consequent poor penetration of blood into the peripheral vasculature.

Depending upon which theory appears most reasonable to him, the individual surgeon will use procedures which seem, in the light of that theory, most likely to avoid these cerebral complications.

PROCEDURES ON CAROTID ARTERY

(1) Preliminary compression of the common carotid over the tubercle of the sixth cervical vertebra.

(2) Preliminary narrowing of arterial lumen by metal bands.

(3) Gradual throttling of lumen by clamps[34] or fascia bands.[37]

(4) Simultaneous ligation of internal jugular vein.

(5) Preliminary clamping for several hours of vessel to be ligated.

(6) Ligation of internal carotid.

(7) Ligation of common carotid.

(8) Ligation of common carotid with simultaneous ligation of external carotid.

(9) Ligation of common carotid with subsequent ligation of a varying number of the branches of the external carotid.

(10) Ligation of common carotid with subsequent ligation of the internal carotid.

Differences of opinion are understandable for many aspects of the problem remain in the realm of speculation. It has not been found feasible to observe the human brain under experimental conditions and the results of experiments upon animals are not always strictly applicable to man. The findings at autopsy, furthermore, are confusing. The post-mortem findings consist of anæmic infarcts but anæmic infarcts are difficult to produce experimentally and pathologists disagree as to the mechanism of their production.

Another confusing factor is presented in the question of thrombosis and embolism. Only a few of the many variables which seem to be involved in the formation of thromboses are susceptible of estimation for clinical use.

Many observations, however, and many enlightening contributions have been made in vascular surgery, physiology, pathology, ophthalmology, and neurology which may be adduced to this particular problem. Demonstrations and conclusions to the study of problems in these other fields, when applied here, make it appear possible to formulate a rational program of procedure.

Anatomy and Physiology.—Inasmuch as the most common explanation of cerebral sequelæ predicates an anæmia of the brain in the sense of a reduced volume flow of blood, it is appropriate at the outset to review the anatomy of the vessels and to refresh our memories with regard to the channels of collateral circulation. Unlike the extremities, and most organs of the body which depend for their nutrition upon one main artery, the brain is abundantly supplied by four great vessels—each originating in the high-pressure areas of the aortic arch or the subclavian vessels. No part of the body seems so efficiently protected against failure of blood supply as the brain.

Each internal carotid equals the basilar in diameter and it would be more correct probably to say that the brain is supplied by only three main vessels. On the basis of such calculation, the obliteration of one internal carotid should reduce the volume flow to the brain by one-third. The exact amount of reduction in any given patient would be difficult to estimate, as compensatory dilata-

tion of the collateral channels is very prompt. The relatively greater volumes, however, carried by the carotids should be borne in mind when and if anyone contemplates such an undertaking as bilateral ligation of the common or internal carotid. In spite of the few successful bilateral ligations on record, it is not a rational procedure. The reduction by two-thirds of the volume flow to the brain is too great to be successfully restored by the otherwise generous collateral provisions with which the brain is supplied. Those few patients who have survived bilateral ligation have almost invariably shown mental deterioration. The importance of the opposite carotid, moreover, should not be lost sight of in unilateral ligations. Homans[31] and Guinard[26] sounded this warning after each, having ligated a common carotid, autopsied their patients and found only weakly developed and poorly functioning vessels opposite the ones they ligated.

After ligation of the common carotid artery, the circulation to the brain is carried through: (1) the opposite internal carotid; (2) the circle of Willis; (3) the angular with the ophthalmic; (4) the internal carotid on the side ligated by means of the reversed currents down the external carotid and past the bifurcation. This reversal results from the following anastomoses: (*a*) the inferior with the superior thyroid; (*b*) the deep cervical branch of the costocervical trunk with the descending branches of the occipital; (*c*) the superior thyroid, lingual, facial, occipital, and temporal, with the corresponding arteries of the opposite side.

Ample evidence is afforded in individual case reports that these named vessels dilate rapidly and carry vigorous circulation around a ligature upon the common carotid.

In addition to these larger well-known channels, there are numerous other anastomoses between smaller vessels of the two sides. Thus, Elschnig[17] showed that when in the cadaver the ophthalmic artery was divided from the internal carotid, the latter tied and a liquid, under the low pressure of 60 mm. of water, was injected into the external carotid or internal maxillary of the same side, such liquid could be seen to flow from the cut end of the ophthalmic in a relatively short time, and that finally both orbits and both sides of the face were filled with the injection fluid. He concluded that "the ocular blood supply must be in part derived from the external carotid, the branches of which communicate freely on both sides." Dawbarn[12] remarks that "it is known to everyone that there are thousands—myriads—of nameless little vessels interlocking at the median line by which the freest anastomoses are quickly restored. Even after bilateral ligation of the external carotids, the resulting anæmia is of short duration only," and "after complete excision of the superficial carotids on both sides with each of the eight branches on both sides separately controlled, there remained twenty-nine distinct routes by which blood could still enter the area from outside systems."

The retrograde flow from the anastomoses of the external carotid down the external, past the bifurcation, and into the internal has been recognized

by at least twenty authors whose writings have been brought to our attention. The following men speak of it as an accepted fact: Baroni,[4] Caudry,[8] Fisher,[20] Freeman,[22] Guinard,[26] Katz,[35] Keegan,[36] Kolodny,[38] Krampf,[39] LeFort,[41] Lenormant,[43] Le Fourmenstreaux,[42] Matas,[50] Perthes,[57] Ransohoff,[59] Romanis and Mitchiner,[60] Stierlin and von Meyerberg,[63] Trotter,[66] Whale,[71] and Weeks and Gilson.[69]

PLATE A.

In attacking an arteriovenous fistula of the left internal carotid-jugular tract at the bifurcation, Matas[50] placed an aluminum band on the common carotid and another on the internal jugular vein just above the clavicle. Reopening the wound some time later, he found the fistula still active and fed by an arterial current coming down the external carotid and into the internal and through the fistula into the jugular. Placing clamps upon the internal and external carotids and upon the internal jugular above the fistula, he performed an endo-aneurismorraphy, removed the clamps, and found the circulation down the external and into the internal soon reëstablished.

Lenormant[43] comments upon an operation in which he assisted Petit-Dutaillis to resect an aneurism of the bifurcation with an immediate end-to-end anastomosis of the stump of the external carotid with that of the internal carotid. He remarks that in the course of the operation the clamp slipped of the internal carotid and he was surprised to see practically no bleeding, indicating a very small pressure down the internal carotid. After reunion of the two vessels, good pulsations were immediately established in both vessels. There were no cerebral complications and about one year later he still found good pulsation in both vessels. My own experience I have recounted before.[16] Reopening the neck three weeks after ligating the common carotid, I found the internal and external pulsating above my ligature. By clamping as indicated (Plate B) and using various combinations of the clamps in the positions indicated, I demonstrated that the blood was flowing under good pressure down the external and up the internal. I have verified this phenomenon in about a half-dozen ligations since I first observed it three years ago. As a result, I have arrived at the following rough estimations.

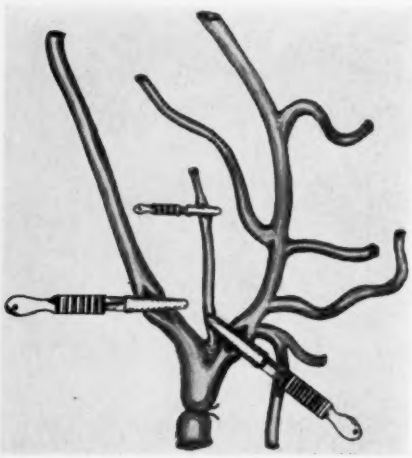

PLATE B.

Ligation of the common carotid reduces the blood flow in the internal carotid by about 50 per cent. Almost half of the recurrent flow from the external carotid comes through the superior thyroid. With confirmatory observations by other men, I believe that this retrograde current through the external carotid is a normal phenomenon after ligation of the common carotid, and that it may be looked upon as a very important channel of collateral circulation to the brain when the common carotid is ligated.

Inadequacy of the collateral circulation through the circle of Willis is commonly held responsible when cerebral symptoms follow internal or common carotid obliteration. This impression has been made, most likely, by isolated reports of autopsies in which deficiencies in the circle have been found. In 1889, S. Weir Mitchell[54] called attention to sixteen anomalies in the posterior communicating arteries, in nine of which these vessels were absent or impervious. In 1905, DeVries[15] noted forty-five of the same vessel, in seven of which both arteries were absent. The difficulty with these reports is that they give no estimation of how many times these anomalies occur in consecutive autopsies;—that is, whether we should expect to find sixteen, or forty-five, anomalies in each 500, or in every 5,000 persons.

In Fawcett's and Blackford's studies[18] of 700 consecutive autopsies and in Windle's[72] of 200, we may be able to obtain fairly reliable averages.

	Fawcett and Blackford		Windle	
		COMPLETE AND SYMMETRICAL		
	510...72.8%		103...51.5%	
Complete but asymmetrical				
Left posterior communicating larger than right (Plate C, Fig. 1)	64		15	
Right posterior communicating larger than (Plate C, Fig. 2)	87		28	
Left posterior cerebral from internal carotid (Plate C, Fig. 3)	4		9	
Right posterior cerebral from internal carotid (Plate C, Fig. 4)	6		11	
Interior communicating shaped	2			
Total		163...23.3%	Total	63...31.5%
		INCOMPLETE		
Left posterior communicating absent (Plate C, Fig. 6)	10		13	
Right posterior communicating absent (Plate C, Fig. 7)	13		9	
Both posterior communicating absent (Plate C, Fig. 8)	3		3	
Anterior communicating absent (Plate C, Fig. 9)	1		9	
Total		27....3.8%		34...17 %

Analyzing the incomplete items, Fawcett and Blackford[18] remark that "one posterior communicating vessel is sufficient to maintain the circle." Windle[72] notes that in every case in which he found one or both posterior communicating vessels absent, there were communicating vessels present between the basilar and internal carotids. (Plate C, Fig. 10.) In other words, in twenty-five of the thirty-four specimens, in which he noted anomalies, there was no actual deficiency. Furthermore, in seven of the nine absences of the anterior communicating vessels, the absences were due to fusion of the anterior cerebrals (Plate C, Fig. 9), where a communicating vessel would be superfluous. In the remaining two, there was absence of the anterior cerebrals on one side (Plate C, Fig. 11), and the cases were insane subjects. This leaves one missing anterior communicating vessel in 900 fully developed brains. Busse[7] examined 400 brains for the anterior communicating artery only. He found none absent, and in 227 of these 400, the anterior vessel was multiple. We may assume, therefore, that absence of the anterior communicating artery is

an extremely rare happening—only one being absent in 1,300 brains which were examined.

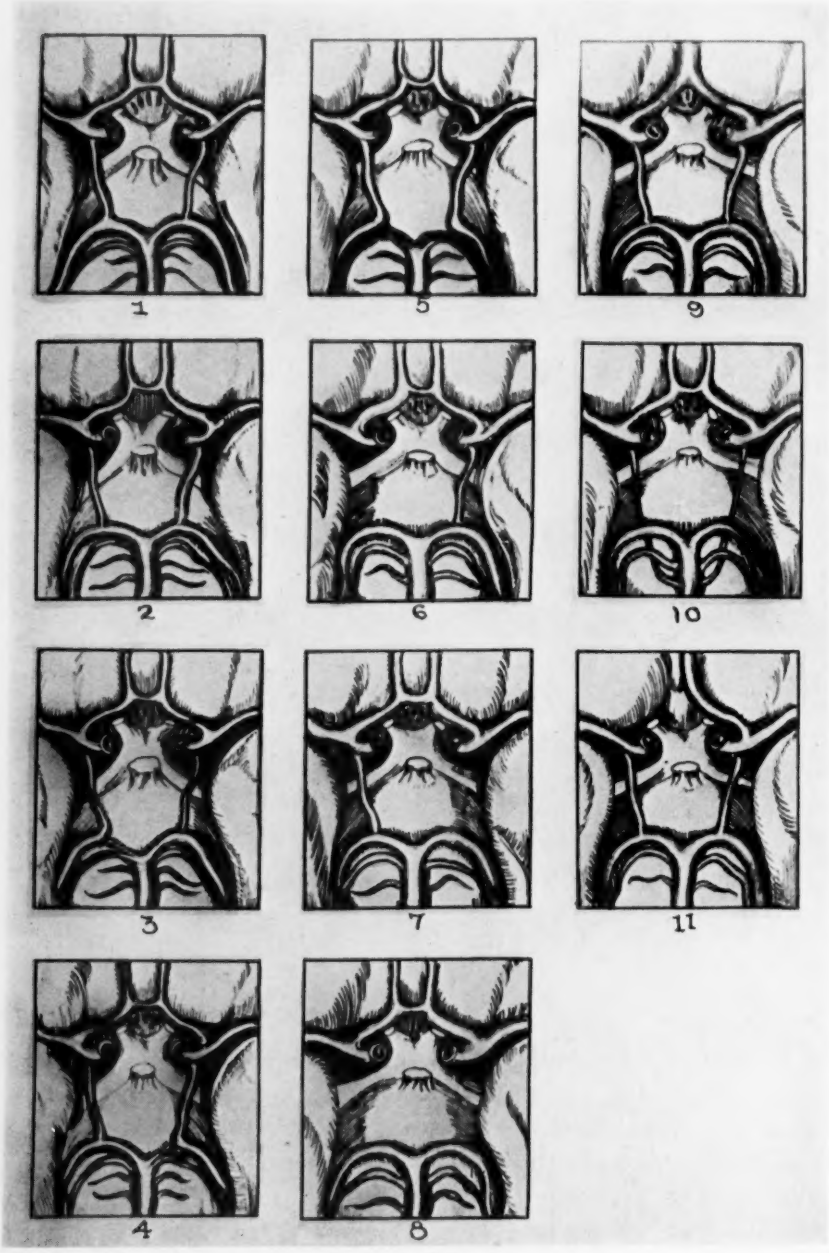

PLATE C.

In the posterior half of the circle, frequent mention is made of the absence of one or both posterior communicating vessels, but Windle notes that in every case the absence of these vessels was compensated for by other vessels con-

necting the two halves of the circle. Therefore, while anomalies occur, they do not occur so commonly as symptoms following ligations. When anomalies of the circle of Willis are encountered, the question may be asked—do they adversely affect the blood supply to the brain? D. J. McCarthy and M. K. Meyers,[51] Pfeiffer,[58] Friedemann,[23] and others[13, 75, 31] do not believe so. McCarthy and Meyers state, "It has been shown experimentally that constant pressures are maintained in the vessels of the circle of Willis when the blood supply of one of its branches, or its supply artery, is cut off," and that "irregularity in the size of the individual vessels of the circle of Willis would not, in all probability, have any disturbing influence either as to structure or function." Le Fourmenstreux believes such anomalies to be of little importance as "considerable variation is compatible with functional efficiency." Zimmermann[74] comments upon the number of autopsies in which no anomaly of the circle of Willis was noted. Homans was unable to find in the literature any death following a carotid ligation in which an anomaly of the circle was demonstrable. Friedemann and Elkeles performed the interesting experiments on dogs of perfusing dye materials through each of the four nutrient vessels of the brain while the other three vessels were ligated. In every instance, they found all parts of the brain uniformly stained. Such experiments on the dog may be said not to hold true in the human brain, but the recent monumental work of Pfeiffer[58] on the anastomoses of the cerebral blood-vessels would incline one to believe it. Pfeiffer demonstrates, macroscopically and microscopically, a regulating mechanism within the brain of an extremely complicated but purposeful architecture. In this regulatory mechanism he demonstrates vessels which he terms "throttles" for lowering pressures and "injector vessels" for speeding up the circulation, by means of direct connections between the basal vessels and capillary beds. For equalizing pressures between two or more remotely situated capillary beds, there are vessels of greater calibre than capillaries, and these connecting vessels possess the ability to reverse currents. Reversible currents are common, as are also anastomoses, in all parts of the brain, between arteries, and between arteries and veins. Consequently, it is believed that all blood which reaches the basal arteries is distributed equally and under constant pressure to all parts of the brain. A reduction in total volume reaching the basal vessels would, in the same way, affect evenly every area of the brain.

With a normal carotid vessel on the opposite side of the neck; with the knowledge that anomalies of the circle of Willis are rarely of sufficient importance to impair its functional integrity; with recognition of the many collateral avenues through which blood may reach the brain when one carotid is obliterated, it is difficult to ascribe all of the many reported complications to an anæmia of the brain.

We would not have you think we deny the possibility of any reduction in volume flow to the brain. Quantitative reductions do occur. It is for this reason that we advise primary ligation of the common carotid with subsequent ligation of branches of the external instead of primary ligation of the internal

carotid. We do deny, however, the theory that reductions are of such magnitude as to account for all of the many accidents reported.

Thrombosis and Embolism.—Turning to the question of thrombosis and embolism, it will be necessary to summarize. Discussion in detail of the many concepts relative to these phenomena would lead us too far afield. In such a summary, we find universal agreement with the statement of Ludwig Aschoff[2] that "thrombosis is the function of a number of variables." In other words—it has no single cause.

The variables listed by Aschoff consist of slowing of the blood-current, changes in the vessel wall, changes in the blood plasma, and changes in the blood elements.

Variables in the Production of Thrombosis.—First, slowing of the blood flow; second, changes in the vessel wall; third, changes in blood plasma: decrease in coagulation time; increase in decomposition products; increase in protein substance; increase in blood CO_2; increase in blood calcium; increase in fibrinogen-globulins; fourth, changes in blood elements: decrease in sedimentation time; increase in leucocyte count; increase in platelet count.

Undoubtedly many of these factors influence thrombosis, as they have been observed clinically associated with thrombosis. Several facts in connection with these observations, however, must be noted. In the first place, it is agreed that not all of these factors are operative in each and every case of thrombosis. Secondly it is agreed that no one of these factors is in itself sufficient to produce thrombosis.

The experiments of Baumgarten,[5] in which he found blood in the doubly ligated segment of an artery, remaining fluid over a period of days, have been amply confirmed by Malyschew,[47] Delrez,[14] McLean,[52] and Armentrout.[1] We must accept as true the conclusion that slowing and stagnation alone do not produce thrombosis. In 1915, McLean,[52] in a large series of animals, discovered that repeated crushing of vessel walls resulted in a thickening of the vessel wall only, the intima remaining smooth and glistening with no suggestion of thrombosis. In 1929, Miller and Rogers[53] had a similar experience, and definitely showed that an uncomplicated injury to a vessel wall does not cause thrombosis. It is common knowledge, moreover, that all of the changes in the blood plasma, and in the blood elements, noted in cases of thrombosis and embolism, are also observed in various states of health and disease where no thrombosis occurs. It is not a correct conclusion to assume that the blood changes observed associated with thrombosis are alone responsible for that thrombosis.

Of the three primary factors; slowing of the blood-stream, changes in the blood wall, and changes in the blood itself, it appears that at least two must operate simultaneously.

Distillation of the enormous number of experiments, clinical studies, and the conclusions therefrom, would seem to present us with one basic fact. That one fact is that changes of a marked character in the blood itself are essential to the production of thrombosis. In addition, at least one other

factor, either of stasis, or of vascular wall damage, is essential, but the rôle of either consists in acting as a precipitating or localizing agent. Miller and Rogers made the interesting discovery from a study of all cases of thrombosis and embolism occurring in the Massachusetts General Hospital between the years of 1900 and 1927, that the site of operation, the extent of operative trauma, and wound infection did not appear to be of major importance, inasmuch as the primary thrombus was usually found in the femoral or iliac veins, regardless of the site of operation. The decrease in the rate of circulation was designated as the most important single factor, and was thought to be due to the long recumbent position in bed, plus the depression of the circulation produced by anæsthesia and operative procedures. Miller and Rogers admit, however, that other factors were present. These other factors consisted of changes in the blood predisposing to thrombosis, and a localizing factor in the veins indicated. In purely medical cases, thrombosis and embolism are most frequently encountered in states of marked debility, such as those of advanced cancer, acute infections, and advanced cardiovascular disease. Here many and severe changes in the blood are easily demonstrable. The precipitating causes are slowing of the blood current secondary to cardiac decompensation, and localized vascular disease. In the field of traumatic surgery, the factor of local infection plays a more important rôle, but it should be noted that, even in such cases, thrombosis occurs only when the local reaction is sufficient to produce blood changes, and the local slowing of the blood-stream and the local damage to the vascular walls are sufficient to precipitate the reaction of thrombosis.

An important observation in regard to wound infections in the vicinity of arteries is that infections do not seem to produce thrombosis except where the infectious agent is able to penetrate the vessel wall and act directly upon the slowed or stagnated blood-stream. It is for this reason that, in the presence of wound infection, the occurrence of a secondary hæmorrhage through sloughing of ligatures, or by erosion of the vessel wall, is a more frequent complication than thrombosis. When, however, there be devitalization of the vessel wall with subsequent necrosis of that wall and the products of that necrosis act directly upon a stagnated column of blood within that vessel, coagulation thrombosis almost invariably occurs. The media of arteries is rich in thromboplastic substances, and necrosis of a vessel may be an aseptic process, and still produce coagulation thrombosis. In the small amount of blood stagnated in the vicinity of a ligature, if any of the vessel wall be compressed sufficiently to produce necrosis, the concentration of thromboplastic substances released into that small amount of stagnated blood may produce coagulation. Torraco[64] demonstrated this fact in 1929 when, in spite of rigid asepsis, he found thrombi constantly present when he used coarse or redoubled ligatures. This finding of Torraco was confirmed by Barcaroli[3] in 1931 and both confirm the earlier demonstrations of Marchand,[49] and Travers.[65] For the same reason, the presence of foreign bodies, in contact with the vessel ligatured, was found to be important in the determination of thrombosis. A

higher incidence of thrombosis is noted also when clamping of an artery preceded its ligation.

Knowledge of these facts explains the difficulty with which thrombosis is produced in the experimental animal. Healthy vigorous animals are used; rigid asepsis is preserved; the animals are restricted in their activity for the duration of the operation only, and the presence or absence of thrombosis depends upon the amount of vessel wall devitalized.

It is evident, therefore, that with reasonable asepsis, there is no more reason to anticipate local thrombosis, after ligature of the carotid vessels, than after ligature of a vessel in any other part of the body. As a matter of fact, no more do occur, and thrombosis of a cerebral vessel as a result of a thrombosis arising from the point of ligation of a carotid vessel, or cerebral embolism by fragmentation of a local clot, does not account for the high incidence of cerebral symptoms following such ligatures.

Sympathetic Stimulation.—In order to arrive at logical conclusions with regard to the rôle of sympathetic irritation in the production of the sequelæ of carotid ligations, it is necessary to return to our anatomy.

Lying on the prevertebral fascia, posteriorly and internal to the carotid sheath, the trunk of the sympathetic communicates with practically every nerve structure in the neck. It supplies vasomotor branches to the walls of the common, internal, and external carotid vessels, and their respective branches. It supplies motor fibres to the involuntary muscles of the orbit and eyelids, dilator fibres to the pupils, accelerator fibres to the heart, and secretory fibres to the salivatory glands. The superficial cervical ganglion lies opposite to the transverse processes of the second and third cervical vertebrae. The internal division of the ascending branch of this ganglion is known as the carotid nerve. It forms an arborization over this vessel and constitutes the nerve supply to the branches of the internal carotid. Stimulation of the sympathetic cord in the neck produces dilation of the pupils, protrusion of the eyes, paleness and coldness of the skin of the face and neck, dryness of the mouth, and acceleration of the heart. Stimulation of the superior ganglion, or carotid nerve, produces constriction of the cerebral branches of the internal carotid on the same side of the head.

In the vessels of the extremities, Leriche[44] has attempted to demonstrate the important rôle played by the sympathetic nerves of arterial walls in the causation of the sequelæ of the ligations of these vessels. Sequelæ such as cyanosis, coldness, paralysis, and ulceration he believes to be due to vasoconstricting reflexes excited by the irritation of the sympathetic fibres in the vessel wall, when that wall is compressed by a ligature. He believes that the vasoconstricting impulses are more important than ischæmia in the production of these sequelæ. According to this conception of Leriche,[44] a ligated vessel, while no longer a channel for blood, continues to convey a group of sympathetic nerves in a state of chronic irritation. From his personal success in avoiding these sequelæ, by resection of a portion of a vessel, instead of simple ligation, he believes he cuts the channels through which these vasoconstricting impulses flow, and thereby produces peripheral dilatation.

Several objections militate against the strict application of this theory in ligations of the carotid vessels. The first objection is that, in the experimental animal, stimulation and resection of the cerebral sympathetic is performed upon the superior ganglion or upon the carotid nerve, and not by manipulations of the carotid vessels. A second objection is that, should ischæmia, due to vascular constriction, constitute the mechanism of production of the symptoms often noted after the occlusion of one carotid vessel, the entire area of the brain supplied by that carotid should present more uniform softening in those cases which come to autopsy. Anatomically, the foci of the so-called white softening are limited, as a rule, to small areas and have no uniform distribution. Although frequently located in the regions of the basal ganglia, they may be as far removed as the occipital lobes. In the third place, from a clinical viewpoint, it should be noted that, were conditions exactly analogous in the neck and in the extremities, we should expect sequelæ to follow obliteration of the carotid vessels as frequently as coldness and cyanosis follow obliteration of the main vessel of an extremity. Furthermore, we should expect these sequelæ to occur in young subjects almost as frequently as in those of more advanced years. The fourth and most important objection is that stimulation of the sympathetic does not produce the symptoms which are observed after ligation of the common or internal carotid. Stimulation of the cervical sympathetic produces coldness, and paleness of the skin of the face and neck, dryness of the mouth, acceleration of the heart, and an increase in blood-pressure. This is the picture of sympathetic overactivity. The symptoms which occur after ligation of the common or internal carotid are those of shock, faintness, low blood-pressure, slowing of pulse, and cold sweat. This is the picture of vagus overactivity, and, from an anatomical and operative view, it would seem more likely that the vagus nerve might be irritated, in operating upon the carotid vessels, than that the sympathetic would be irritated.

In man, our sole opportunity to observe the reactions of a branch of the internal carotid under experimental conditions lies in the retinal vessels of the eye. Anatomically and from a developmental viewpoint, the ophthalmic artery is a part of the cerebral system of arteries and we may safely assume that the reactions of the ophthalmic artery are identical with those of the anterior and middle cerebrals. Recently, Gollwitzer and Schulte[25] made a study of the changes the retinal vessels undergo under conditions corresponding to ligation of the internal carotid artery. Simultaneous tracings record the systemic blood-pressures and the intravascular pressure below a clamp on the internal carotid. Arrows in the blood-pressure curve mark the moments at which calibre alterations in the retinal vessels were noted and photographed. (Plate D.) As the systemic blood-pressure begins to fall there occurs a constriction of the retinal vessels (Plate D, Fig. b), but when the blood-pressure continues to fall rapidly, and to a point far below its accustomed level, the constriction of the retinal vessel relaxes, the vessel walls pass into a state

of dilatation (Plate D, Fig. c) and finally in a condition which might be termed flaccid paralysis (Plate D, Fig. d) with almost complete arrest of the blood-stream filling them. In the youthful individual, the recovery from this abrupt extreme fall of blood-pressure is fairly prompt. In those of advanced years, however, whose blood-vessels have lost the resiliency of youth and whose cardiac musculature moreover may no longer be capable of efficient response to unusual demands, the state of extreme depression may be prolonged.

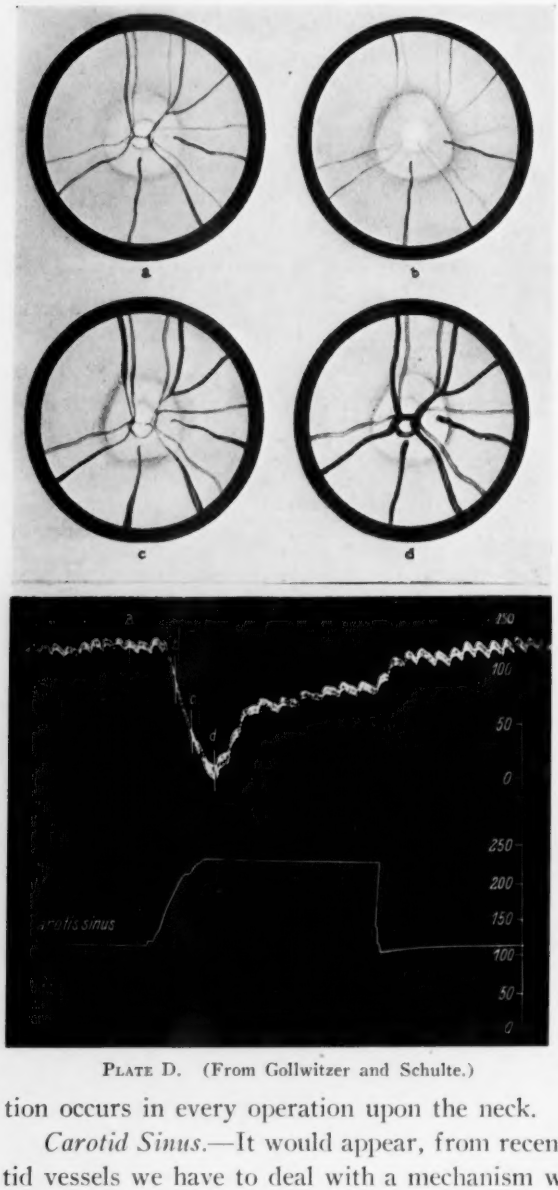

PLATE D. (From Gollwitzer and Schulte.)

Inman,[33] in 1920, and again last year directed our attention to the fall of blood-pressure and slowing of the pulse which accompanies the attacks of vertigo, paræsthesia, and transient hemiplegia, which are common episodes in the lives of hypertensive and arteriosclerotic patients. These symptoms have been ascribed to cerebral arterial spasms.[40] From the work of Inman they would be accounted for more properly by an acute passive congestion of the cerebral tissues. The cerebral complications of carotid ligations would not, therefore, seem to be satisfactorily explained on the basis of sympathetic stimulation. Vagus irritation would more adequately explain these complications and it is likely that a certain amount of vagus stimulation occurs in every operation upon the neck.

Carotid Sinus.—It would appear, from recent researches, that on the carotid vessels we have to deal with a mechanism which has received little or no publicity in America. I refer to the web of nerve filaments in the walls of the carotid bifurcation which has received the name of carotid sinus. Here the vessel wall is somewhat thinner than that of adjacent parts of the artery

and contains in the deeper part of its adventitia a rich network of nerve filaments. This network is confined strictly to the limits of the sinus and forms the sinus nerve which joins the glossopharyngeal. Connections have been thought also to be made with neighboring structures such as the vagus, the superior cervical ganglion, and the hypoglossal. The mechanism thus constituted has been found to form the physiological component of the aortic nerves and, with the aortic nerves, exerts a powerful influence upon the heart rate, the blood-pressure and respiration. Because of their stabilizing influence upon the circulation, these nerves, the aortic and the sinus, have been termed by Wright[73] the "buffer nerves of the circulation." Their natural functions are depressive and their rôle in the physiological economy consists in acting as governors or counter-balances to the sympathetics. The carotid sinus part of the combination seems to be concerned particularly with regulating the circulation to the brain. The nerve terminals in the walls of the carotid sinus function as pressure receptors and as such are very sensitive to change in intravascular pressures within the carotid and also to extravascular pressures. Compression of the sinus or a rise of pressure within the carotid sinus produces a slowing of the heart rate and a reduction of blood-pressure, Thomas Lewis,[46] two years ago, showed that it is the stimulation of this carotid sinus mechanism which produces the syndrome previously described by him as "vasovagal syncope."

Slowing of the heart rate evidently takes place through the vagus, as, after paralysis of the vagus terminals by atropine, no slowing of the heart occurs. Electrocardiographical studies reveal that in the heart itself the effect consists of reduction in the conductility of the bundle of His. In the presence of a damaged myocardium, a complete cardiac arrest has been known to occur. Lowering of the blood-pressure is accomplished by active vasomotor dilatation involving chiefly the splachnic and cerebral areas. The vasodilatation is associated with an inhibition of adrenalin secretion. Further effects of stimulation of the sinus are seen in a decrease in rate and depth of respiration which may be so marked as to end in apnœa. Removal of all stimulation to the sinus, by reduction of pressure in the carotid, suppresses the activity of the sinus mechanism and results in the reverse of these phenomena. We see, therefore, an increase in heart rate and depth of respiration, accompanied by an increase in the secretion of adrenalin.

Details of the work which has produced this new knowledge is rapidly forming a large volume. Suffice to say that the work of Lewis,[46] Wright and Kremer,[74] Danielopolu,[11] Hering,[29] Gollwitzer and Schulte,[25] Mandelstamm and Lifshitz,[48] leave no room for doubt that we have here a perfectly normal structure whose activity is so far-reaching that it cannot be ignored in any operation upon the neck, and especially in any procedures upon the carotid vessels.

In the clinical use of this knowledge, some details should be noted. Mandelstamm and Lifshitz reported to the 1931 Congress of Internal Medi-

cine in Moscow their observations of this mechanism on 330 patients. They reported the following conclusions:

First, mechanical irritation of the carotid sinus in man released a strong depressor reflex upon the heart and circulation.

Second, control pressure over other vascular areas did not produce this reflex.

Third, there was no difference between the right- and left-sided reflexes, nor any difference between sexes.

Fourth, the frequency and intensity of reflexes showed marked difference at different ages.

In younger patients, it was possible to elicit the reflex in only 25 per cent. of the subjects and in this 25 per cent. the reflex consisted of a trifling reduction of blood-pressure for an average of 5 mm. of mercury. In older patients, the reflex was elicited in 96 per cent. of the patients and in these the fall of the blood-pressure averaged 37 mm. of mercury. In patients presenting arteriosclerosis and hypertension, the depression bore an inverse ratio to the height of the original blood-pressure. In this group depressions were noted to the extent of 100 to 110 mm. of mercury.

Other observers have recorded that the reflex is exaggerated by chloroform anæsthesia, by morphine, and by digitalis; that it does not seem to be affected by ether, and that its action is suppressed by local infiltrations of cocaine. The reaction furthermore shows no tendency towards fatigue. It is persistent so long as intravascular pressures remain constant. The reflexes reported have been produced by compression of the carotid vessels over the site of the sinus, or by increasing the intravascular tension.

It is obvious, therefore, that ligation of the internal carotid, with a building up of pressure back of the ligature, would tend to stimulate the sinus. Many of the symptoms noted after such a ligation could well be due to this mechanism. On the other hand, ligation of the common carotid reduces pressure within the sinus and thereby reduces its inhibitory effect. A complete release of inhibition over the cardiac accelerators may occasionally produce extra systoles and fibrillation. Demonstrations of such effects produced through the channels of the carotid sinus would nominate this sinus as of major importance in the explanation of the sequelæ of carotid ligations.

Comments.—We see, then, that the obliteration of the common or internal carotid artery involves the consideration of conditions which do not obtain in ligations elsewhere.

Many ligations have been performed in the presence of conditions which we now recognize as contra-indications. Low blood-pressure, shock, anæmia, sepsis, and debilitating disease constitute contra-indications in ligations of election, but are necessarily disregarded in the emergency situations of hæmorrhage, extension of a hæmatoma, or the development of acute dysphagia or dyspnœa.

Recognizing that ligation of the common carotid reduces the volume flow in the internal carotid by approximately 50 per cent. only, it is obvious that

ligation of the common carotid constitutes a partial ligation of the internal carotid. There would appear to be no necessity therefore, for the procedures of gradual throttling or fractional ligations of the common carotid by the use of special clamps or strips of fascia. It is obvious, also, that ligation of the internal carotid reduces the volume flow of blood to the brain to a greater extent than does ligation of the common carotid. When the internal is ligated primarily, the reduction in volume flow may be in itself sufficient to produce symptoms. It would be particularly likely in the presence of an arteriosclerosis that involved the intracranial vessels.

Since the demonstration, furthermore, that the mechanism of the carotid sinus exists in the bifurcation of the common carotid, we are made aware that ligation of the internal carotid carries with it an additional hazard. By increasing the pressure in the bifurcation back of such a ligature, the depressive action of the carotid sinus is increased. The ligation of the internal carotid, therefore, not only results in a greater reduction in the volume flow of blood to the brain but also produces a greater shock to the cardiovascular equilibrium.

Our present procedure is ligation of the common carotid and, if the reduction in volume flow in the internal carotid be insufficient, secondary ligation, after an interval of a week or ten days of the branches of the external carotid, never entirely abolishing the flow through the internal carotid unless we find it necessary after the other ligations have been tried.

The commonly held conception that obliteration of a vessel is accomplished by the formation of a clot which fills the vessel lumen as far as the next branch vessel is the result of Virchow's teachings[68] which have held so prominent a place in pathology.

Rokitansky[61] taught the facts which we now know to be true, namely, that the obliteration of an artery is not dependent upon the formation of a thrombus. His opinions, however, were submerged by those of his more prominent contemporary. While Rokitansky is accredited with the first teachings of these facts, I should like to place on record recognition of the name of Benjamin Travers[65] by quoting excerpts from a paper he read in London on October 26, 1813.

To ascertain with precision the effects of ligatures of various sizes, I have repeatedly examined the appearances left upon the cuticular coat of an artery after applying them, and the following is a report of such experiments upon the carotid, iliac, and femoral vessels of the human subject.

TRAVERS' EXPERIMENTS

Broad tape	no distinct impression but a general.
Narrower tape	longitudinal puckering of inner coats especially opposite the knot.
Narrow tape	the same with partial laceration.
Narrower tape	cuts with fretted edge or partly cuts and partly tears.
Flat bobbin	the same.
Large round bobbin	cuts cleaner.

Twist ..... clean and narrower incision.
Twine ..... the same.

Round ligature including sheath of linen upon the artery ..... faint but distinct incision.

Round ligature, including cylinder of quill, wood, or other firm substance ..... deep but partial incision.

It being established that the internal coat of an artery is prone to take on adhesive inflammation and that it is by virtue of this inflammation that the vessel can be permanently obliterated, it is not a question of difficult solution whether the mere apposition of sound surfaces, or the apposition of bruised and lacerated surfaces, or the apposition of fresh cut surfaces is the condition most favorable to union.

Mr. Hunter and surgeons after him were in the habit of applying the ligature with force only sufficient to bring the sides of the vessel in contact and some included an extraneous body, as a piece of cork or wood or a roll of linen to prevent the lesion of the artery in the act of tightening the ligature. The fear of cutting the coats of the vessel was uppermost in the minds of all. Scarpa and other eminent surgeons of the continent are still fettered by these fears. But we see that they are groundless, that on the contrary, the security and effect of the ligature are insured by its cutting the middle and internal coats, which it does without damage to the outer, however applied.

In all our experiments, the blood as blood has no concern in the obliteration of a vessel. A coagulum does not adhere to the inner coats of a vessel and could never be competent to permanently obstruct the canal of an artery. Experiments during the past five years confirm these observations of Travers, and could scarcely be summarized in fewer words.

The evidence that even an aseptic necrosis of a vessel wall may provide the essentials of thrombosis formation indicates that all unnecessary trauma to the vessel wall should be avoided. It would indicate that moderately sized round silk ligatures should be used, and tied singly, catgut being used only in an infected wound. It would indicate the avoidance of crushing of the vessel by clamps before the ligature is applied; and the exclusion from contact with the vessel of all foreign bodies, such as the aluminum bands of Halsted,[27] and Matas,[50] and the Neff[55] clamp. It would indicate the inadvisability of using the bands of fascia, Bier's membrane, *etc.*, which have been shown by Pearse[56] to produce pressure necrosis. In a vessel the site of atheromatous degeneration, it would suggest that the preliminary compression of that vessel against the transverse process of the sixth cervical tubercle may so damage the vessel as to favor thrombus formation after ligation.

It has been shown that an aneurism of the internal carotid in its intracranial course in the treatment of which periods of preliminary compression are almost routine is a powerful natural stimulant of collateral circulation. Emile Holman[30] has very adequately demonstrated this fact. It would seem, therefore, that compression of the carotid preliminary to ligation is not only tedious and painful but unnecessary and apt to cause damage to the vessel to be ligated.

Wound infection having been seen to result more frequently in secondary hæmorrhage than in thrombus formation, we drain the wound in the neck, in

the presence of infection in the mouth or nose or throat, not in fear of thrombus, but to avoid secondary hæmorrhage. The wisdom of draining operative wounds in the neck, first taught by Billroth, was amply confirmed during the World War. It is an established practice with those who at that time saw many war wounds of the face and neck, but does not seem to have been adopted so widely as its value merits.

During the past few years in operating upon considerable numbers of mouth and face conditions, we have found it necessary or advisable to ligate an external carotid artery very frequently. Our experience is that the vessel may be ligated at any point in its course with no serious consequences, providing care is observed with regard to drainage, the use of properly sized ligatures, and the avoidance of unnecessary trauma.

Stimulation of the cervical sympathetic nerves, in the sense that such stimulation produces a vasoconstriction of the homolateral half of the brain, would appear to play no more than a minor rôle in the production of cerebral symptoms, if it plays any rôle at all.

The subjective symptoms constituting the reaction to common or internal carotid ligations are those of depression and the objective phenomena are those of cardiovascular inhibition. These phenomena of depression would seem to contain the answer to the question as to whether or not the internal jugular vein should be ligated at the same time as the carotid artery. Ceci[9] recommended this manœuvre on the basis of two operations, in one of which he ligated the carotid alone and had the ligation complicated by cerebral injury; in the other he ligated the internal jugular along with the carotid and no symptoms followed. He reasoned that ligation of the jugular prevented a certain amount of blood from draining out of the cranial cavity and thereby avoided cerebral anæmia. We accept today Barney Brooks'[6] explanation that ligation of the satellite vein, when an artery is ligated, is beneficial in the extremities, not by retaining greater volumes of blood in the extremity, but by causing a more even distribution of the small amount which is present. The brain, however, has been shown to possess highly specialized facilities for the even distribution of the blood. The brain requires oxygen at high tension even though it does not deprive the blood of any great amount of that oxygen. It is not the total volume of blood in the cerebral vessels which determines the proper nourishment of that organ, but the proportion of arterial to venous blood. It is important for the brain that venous blood be returned to the right heart for aëration in the lungs, and any obstruction to that return of blood to the right heart decreases the volume of arterial blood available for return flow to the brain. Since jugular ligation would tend to produce a certain degree of stagnation, we believe that simultaneous ligation of the jugular cannot be approved.

CONCLUSIONS

(1) Cerebral symptoms consequent to ligations of the carotid vessels are usually associated with, and result from, sudden extreme reductions of

systemic blood-pressures. These reductions in blood pressures are produced by the reactions of the carotid sinus mechanism, and most frequently occur following ligation of the internal carotid.

(2) A moderate percentage of complications are due to the reduced volume flow of blood to the brain.

(3) A small percentage of complications may be due to thrombosis and embolism.

(4) Intracranial arterial constriction due to stimulation of the cervical sympathetics does not play any part in the causation of these cerebral symptoms.

(5) Ligation of the common carotid artery reduces the volume flow of blood in the internal carotid artery by about 50 per cent. only.

(6) Almost 50 per cent. of the retrograde flow from the external carotid is derived from the superior thyroid.

(7) Common carotid ligation is a much less hazardous procedure than ligation of the internal carotid.

(8) Cerebral complications following carotid ligations may be lessened by:

(*a*) Ligation of the common carotid with subsequent ligation of the branches of the external trunk. If this is not sufficient, ligate the external trunk itself and the internal trunk consecutively, thereby avoiding primary ligation of the internal trunk.

(*b*) The establishment of careful observation of the blood-pressure during the operation of ligation, and with adrenalin, or infusions, or in the anæmic with transfusions, combating promptly any marked persistent reductions of blood-pressures.

(*c*) The avoidance of those factors such as the compression of the artery before ligation, the use of clamps, fascial or metal bands, and coarse or redoubled ligatures, which have been shown to influence the deposition of thrombi.

By experience therefore and by experimental evidence, we believe we have established the principle that primary ligation of the internal carotid is fraught with danger, and that the practice of primary ligation of the common carotid, with later ligation, if necessary, of branches of the external carotid, should be adopted.

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ASYMMETRICAL BREAST DEFORMITIES

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Perfect symmetry of the breasts is virtually non-existent. In practically every woman careful examination would reveal a slight variation in the size or shape of the mammæ. Sometimes the asymmetry consists of minor differ-

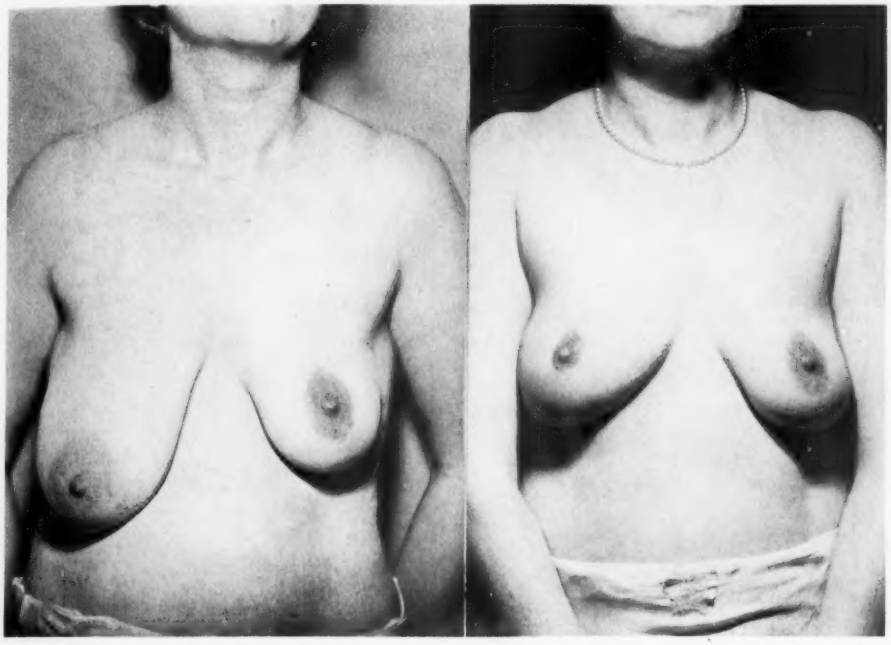

Fig. 1A. Fig. 1B.

Fig. 1A.—Woman, aged thirty-seven, married. Unlateral hypertrophy and asymmetry of the right breast. Asymmetry first noticed at the age of twelve when menstruation started and the right breast began to increase conspicuously in size. No other abnormalities in the general sphere. Following two pregnancies, the enlargement and ptosis of the right breast were disproportionate to the changes in the left. Because of the poor quantitative and qualitative value of the milk, breast feeding was discontinued after a few weeks. Heredity with reference to breast absent.

Examination revealed the right breast to be pendulous and twice the size of the left, which was normal in size but drooping. The right areola also was about twice the size of the left. The patient had been distressed for many years because the breast deformity prevented her from wearing proper clothes and necessitated artificial devices (padded cotton) over the left breast to establish the symmetry of the chest.

Fig. 1B.—Surgical repair consisted of reduction of the size of the right breast and areola, with transposition of the nipple, according to the pattern of the left breast, which was not touched. Because of the shortness of the anterior skin flap the areola was made smaller than on the opposite side. A skin flap taken from the posterior aspect of the breast made up for the shortness of the supra-areolar flap. (Fig. 6, I-H.) This placed the scar above the submammary fold. No secondary modeling of skin and subcutaneous tissue was done as the patient was entirely satisfied with the result obtained.

ences in the areolæ and nipples. Sometimes the proportions of the entire hemisphere of the breast on one side fail to agree with those of its neighbor. Whatever the point of divergence, a slight asymmetry is a common occurrence. It generally manifests itself at puberty, when the rapid development

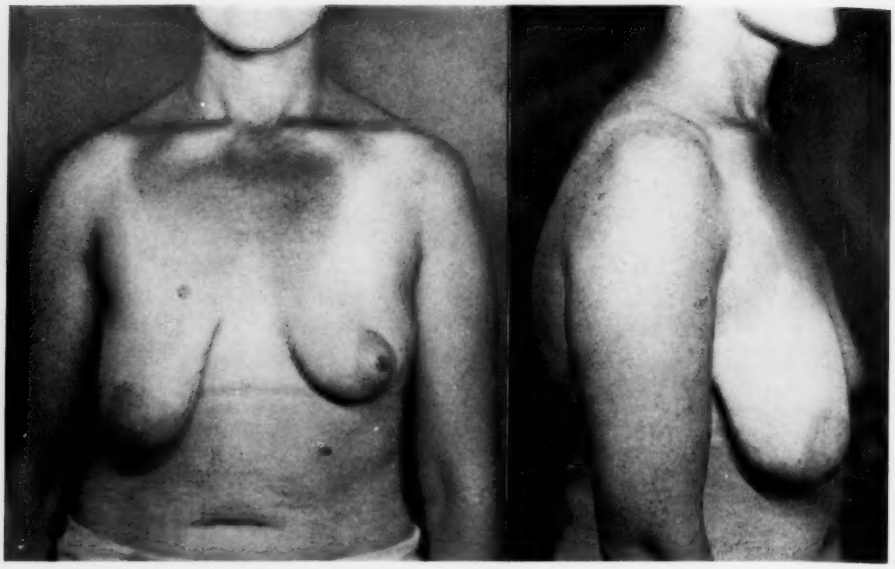

FIG. 2A.—Girl, aged twenty, referred in August, 1931, with unilateral right breast hypertrophy and ptosis. Asymmetry became noticeable at early puberty. Except for breast malformation and a slight protrusion of the thoracic wall on the affected side, general physical examination was negative. The right breast was about twice the size of the left and markedly pendulous, extending to a level of about three fingers above the umbilicus. The left breast was approximately normal in size but moderately pendulous. The right areola was about twice as large as the left, which was also oversized.

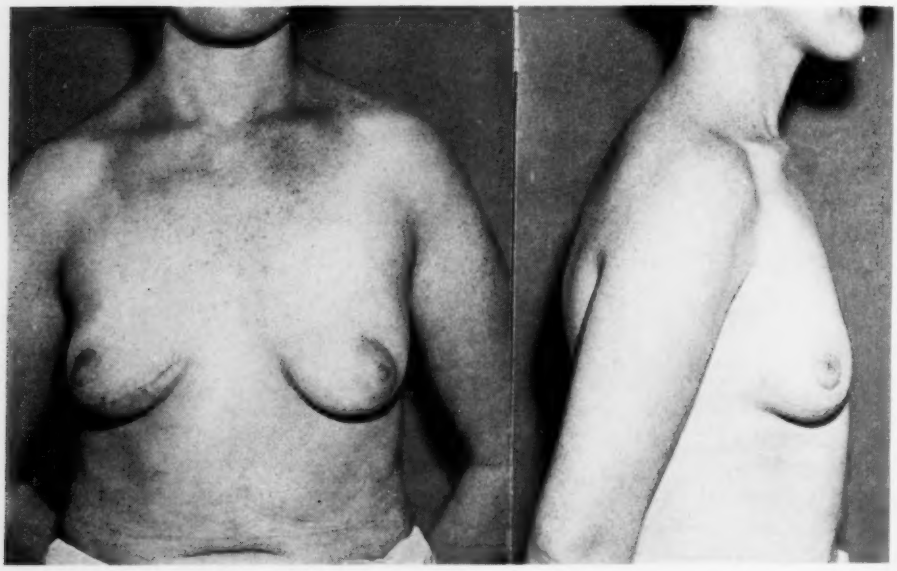

FIG. 2B.—Surgery consisted of unilateral repair of the hypertrophic breast by transposition of the reduced areola and gland. Because of the shortage of skin covering caused by the excessive size of the areola, the lower incision had to be placed above the submammary fold. (Fig. 6, I-H.) This permitted the lower portion of the gland to be covered by skin from the posterior aspect of the breast.

The mental attitude of the patient improved greatly after the successful surgical repair. To satisfy her increased ambition, correction of a nasal deformity was performed in a later stage.

of the mammæ starts. As a rule women are unaware of any difference unless it is pronounced enough to be noticeable when they are fully clothed. Minor variations are clinically as well as subjectively unimportant. Only conspicuous abnormalities will be considered in this paper.

Although pronounced asymmetries of the breasts occur with relative frequency, little has been published on the subject in the medical literature. A false impression of rarity is thereby created, abetted in part by the hypersensitiveness of patients with regard to this condition and their reluctance to discuss it frankly, even with their family physician. In the past year I have operated on five such cases, indicating that deformities of this type are more common than we have been accustomed to think. All of these cases (which included a rather unusual one of micromastia) differed in their morphological abnormalities. On the whole, they were fairly representative of the following classification.

Pronounced asymmetries of the breasts divide themselves into four main types:

(1) Asymmetry due to unilateral hypertrophy, with the opposite side apparently normal. (Figs. 1 and 2.) (2) Bilateral asymmetrical hypertrophy. (Fig. 3.) (3) Asymmetry due to unilateral undevelopment or underdevelopment. (4) Asymmetry caused by a reversed development of the two breasts, such as hypertrophy on one side and underdevelopment on the other. (Fig. 4.)

The first group, which is the most frequent, enjoys many degrees. Those rare cases which comprise the third and fourth groups are characterized by the utmost conspicuousness. In all categories, the use of the term "normal" must be taken with a grain of salt. Whatever the nature or extent of the asymmetry, the supposedly normal breast rarely lives up to its name. Usually there is a greater or lesser degree of ptosis present, supplemented, in many cases, by an abnormal configuration of the nipple and areola.

Etiology.—In all of my cases the asymmetry manifested itself in early adolescence and increased with age. Three of the patients were young girls, ranging in years from eighteen to twenty-four. Two were married women, aged thirty-seven and forty, respectively. What are the causes of the malformations they presented?

It is a prevalent belief that in asymmetrical hypertrophies the larger breast is more common on the left side. The reason advanced for this alleged phenomenon is that right-handed mothers, who are in the majority, prefer to feed their infants with the left breast. My observations do not bear out this supposition. In four out of my five cases the hypertrophy was on the right side. Furthermore, three of the patients were young girls who had never borne children. Obviously we must look further for etiological factors.

Normally the physiological and anatomical changes occurring in the breast at puberty are influenced by hormones of internal secretions. It is readily conceivable that the development of the breasts can be accelerated or retarded by an excess or deficiency of these hormones. This would explain a bilateral

over- or underdevelopment. It does not account clearly for unilateral abnormalities.

The part that pre-natal maldevelopment plays in breast asymmetry is still to be proven, although there is considerable evidence in favor of this theory. It is easy to believe that underdevelopment (micromastia) or a complete lack of development (amastia) is caused by a disturbance of the embryonal germ. Usually these extreme types of mammary malformation are associated with

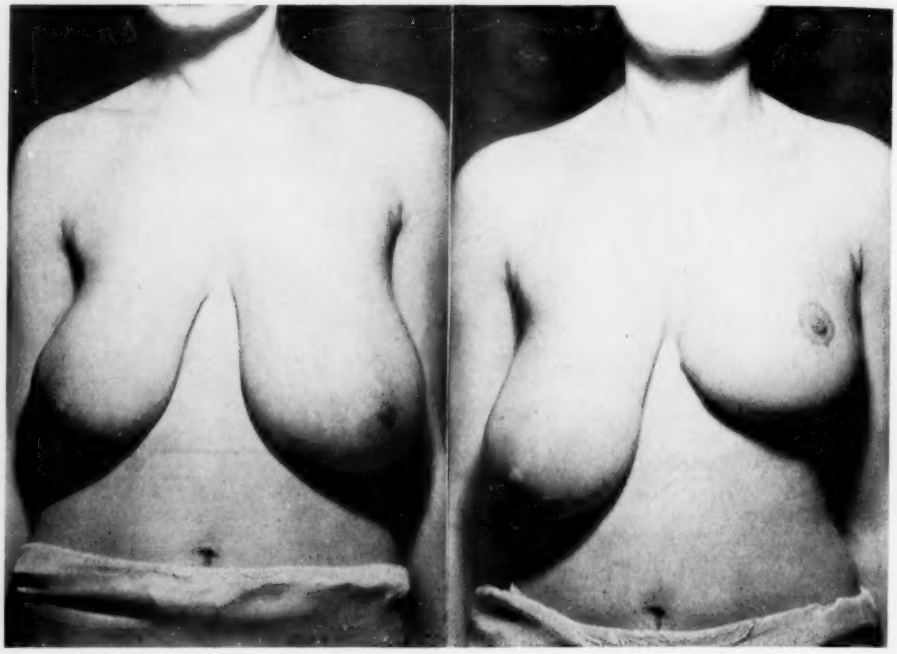

FIG. 3A. FIG. 3B.

FIG. 3A.—Girl, aged twenty-three, referred in December, 1932, with bilateral asymmetrical breast hypertrophy and ptosis. General condition otherwise normal. Both breasts were considerably oversized and asymmetrical at sixteen years and the patient was compelled to wear tight brassieres to conceal the deformed chest. During 1932 both breasts had increased notably in size, particularly the left one. The physical discomfort occasioned by their weight became almost unbearable; pain in the left breast and traction on the shoulders interfered to a great extent with the patient's professional activities. Family history with respect to mammæ negative.

Examination revealed both breasts greatly enlarged, the left much more so than the right. The left breast was abnormally distended, the glandular tissue hard, nodular and painful on pressure. There were no clinical signs of malignancy. A pathological examination of specimen taken from a nodule of the left breast showed the condition to be a cystic fibroma.

Because of this pathology and the marked hypertrophy, the surgical repair was done in two stages. The glandular tissue, particularly that of the left breast, contained multiple encapsulated fibromas.

FIG. 3B.—Condition four weeks after plastic repair of the larger left breast. Repair consisted of transposition of areola and nipple and extensive excision of breast tissue.

other abnormalities of the cutaneous, muscular and osseous tissues of the thoracic wall and the upper extremity. (Fig. 4.) Frequently there is a correspondingly deficient development of the reproductive organs, especially the ovaries. These associated maldevelopments are usually absent in the common forms of asymmetry, although in two of my cases there was a definite deformity of the thoracic wall directly under the larger breast. In one

instance this served to aggravate the deformity as the thoracic malformation further projected the larger breast.

Trauma may be a contributing factor in the undue development of the larger breast as a result of efforts to conceal the malformation by excessive pressure. All of my patients admitted that they had been extremely sensitive on the subject of their mammary abnormality from early adolescence and had tried to produce apparent symmetry by the use of tight brassieres.

In one case (Fig. 3) cystic fibromas were responsible for a rapidly increasing bilateral asymmetrical hypertrophy. In another (Fig. 4) congenital underdevelopment of one breast was accompanied by a pronounced hypertrophy of the other with malformation of the thoracic muscles and the upper extremity on the same side.

Hereditary factors were ascertainable in only one case. In the two married women the dimensional reaction of both breasts to pregnancy had been approximately normal: both mammæ had increased substantially in size and then later contracted again. Lactation had not been possible in either case because of the quantitative and qualitative insufficiency of the milk.

Surgical Repair.—The indications for repair depend on the degree of asymmetry, the age of the individual and the extent of her mental and physical reactions to the deformity. No one of these factors can be considered independently of the others. Where participation in sports is barred by the malformation or evening clothes and bathing suits cannot be worn, it is easy to understand the request for relief from a deformity which is physically and mentally oppressive. Two of the patients described in this article were women of past middle age, married and with mature children when I operated on them. In spite of the many years during which they had had an opportunity to become adjusted to their condition, they were still anxious to be relieved of a defect which had caused them unceasing distress.

In bilateral hypertrophy the size and weight of the breasts often cause great physical discomfort which is aggravated by the difficulty of adjusting the condition to the demands of present-day dress. The asymmetry of the chest, which can be concealed only by cumbersome artificial devices, adds to the conspicuousness of the malformation.

When one side is apparently normal or is not noticeably large and pendulous (Figs. 1 and 2) the indication is for unilateral repair. The oversized breast is reduced to correspond in size and position with the other. When, in addition to an asymmetry, hypertrophy and ptosis characterize both sides, bilateral reconstruction is indicated as the only procedure which will adequately correct the deformity and satisfy the patient.

The procedure of choice for the repair of these malformations embraces transposition of the reduced gland and nipple with window resection for insertion of the areola.[1] Surgery is more elaborate than in the symmetrical deformities because the abnormal breast must be made to correspond in size and position with the opposite side. In bilateral malformations the measurements adopted for the reconstruction are arbitrary and equal on both sides.

In unilateral repair, on the other hand, the operated breast must harmonize in size and form with its supposedly normal mate. This is particularly difficult when the latter is partly pendulous and has an abnormally large areola. A larger breast must then be reconstructed than would be necessary if surgery were bilateral. If the diameter of the areola is excessive, there is apt to be a shortage of skin covering as the anterior flap must not encroach upon the pigmented area and the breast must be made to correspond in size to the

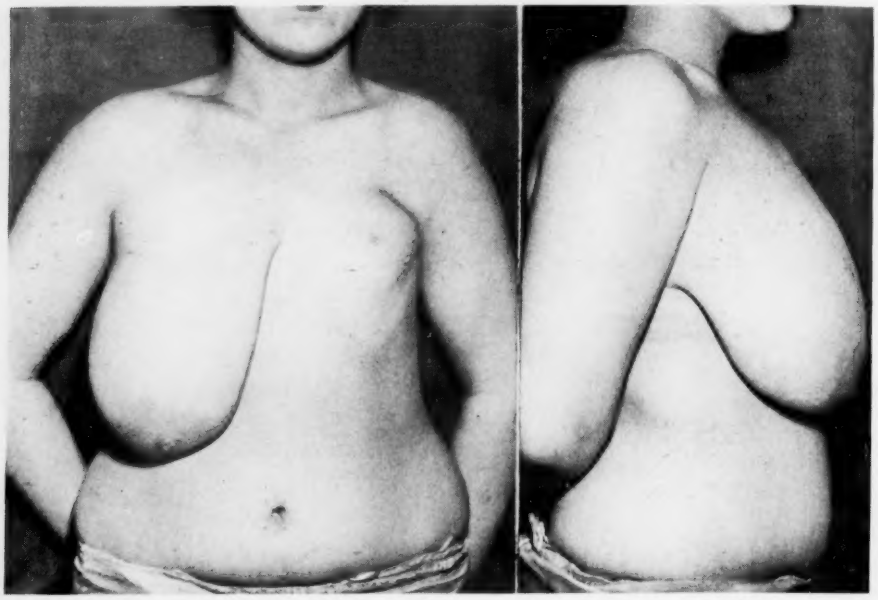

FIG. 4A.—Girl, aged eighteen, referred in May, 1932, with pronounced asymmetry of the chest caused by a reversed development of the two breasts: micromastia on one side and hypertrophy on the other. Asymmetry noticed by the mother when the child was a few months old: already at that time the left side of the chest and back appeared flatter than the right and the left upper extremity was shorter than the right. The birth of the child and subsequent development had been normal except for the malformation noted. Menses began at the age of twelve and were irregular, prolonged and painful. The patient was always overweight: she was heavily built and appeared much older than she was. Except for the disturbance in the functioning of the sexual organs and the marked sensitiveness in regard to the chest deformity, her condition appeared to be normal. Family history with reference to breast negative.

Examination revealed the left breast to be represented by an underdeveloped gland of infantile type with a nipple and areola faintly outlined. The entire left side of the chest was underdeveloped in all dimensions and the pectoral muscle was absent except for the clavicular portion. The muscles of the back were underdeveloped. The shoulder and the entire upper extremity of the left side were shorter than on the right. The right breast was very hypertrophic and pendulous with an areola many times the size of normal; it reached a level of about two fingers above the umbilicus. Because of the infantile type of the left breast, subtotal amputation of the right breast with free grafting of the areola was advised, as it would be impossible to reduce the right breast to correspond in size to the left. The patient and her family objected to this procedure and it was decided to reduce the right breast in successive stages and enlarge the left side of the chest by a fascia-fat graft. (A full report of this case with final end-result will be published separately.)

opposite side. Matching the position of the nipples is another delicate task in unilateral repair. Throughout the latter difficulties are encountered that are not present in bilateral reconstruction, as a result of the necessity to conform to a pattern which is usually far from ideal.

To attain symmetry, both breasts should be exposed during operation and the excision of fat and glandular tissue should be governed by constant comparison in all diameters. It is often necessary to affix the gland to the pectoral fascia to achieve parallel position and the desired shape.

In choosing the method of repair the surgeon must be guided by the ultimate form of the breasts.[2] Some procedures are apt to produce an excessive protrusion which contrasts unfavorably with the slight pendulousness which is usual on the opposite side.[3]

Dangers of Necrosis.—Because of the scarcity of skin there is a tendency to submit the transposed nipple to excessive tension, thus endangering the blood supply. Cyanotic discoloration of the areola, occurring immediately after the nipple is sutured into its new position, is a warning to relieve tension without delay. During the post-operative period venous stasis may be caused by hematoma. Cyanotic discoloration of the pigmented area the day after operation may point to this complication. To prevent it drainage should be

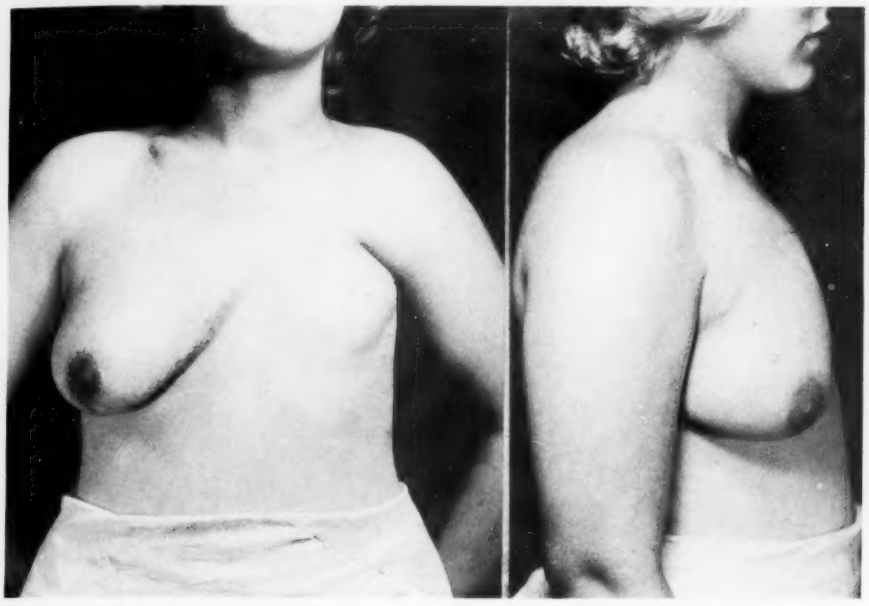

FIG. 4B.—Following second stage of repair by the method of transposition of the nipple and extensive excision of breast tissue.

instituted at the time of operation by means of rubber drains which are removed after twenty-four hours.

Excision of too much glandular structure at one time may also result in interference with the blood supply, especially during the reduction of a markedly hypertrophic breast. (Figs. 3 and 5.) The excessive removal of tissue in one stage is particularly dangerous on the sides, where the main blood supply, provided by the mammary artery on the inside and the thoracic lateral on the outside, may be cut off from the remaining gland to a considerable extent. (Fig. 6, III.) To prevent this contingency, it is advisable to carry out the surgical procedure for the reduction of marked mammary hypertrophy in two stages. At each operation either the external or the internal portion of the gland is left intact to preserve part of the main blood supply. This precaution eliminates the danger of sloughing of the skin or nipple. (Fig. 6, IV and V.)

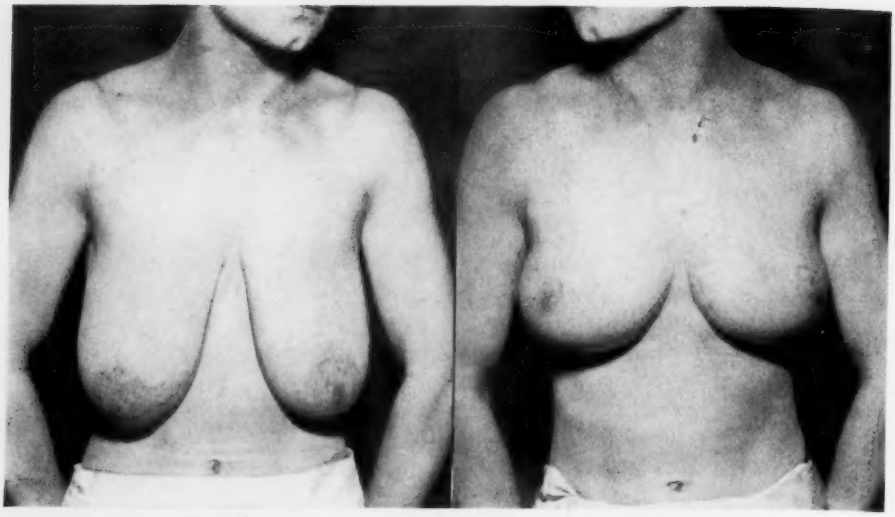

FIG. 5A. FIG. 5B.

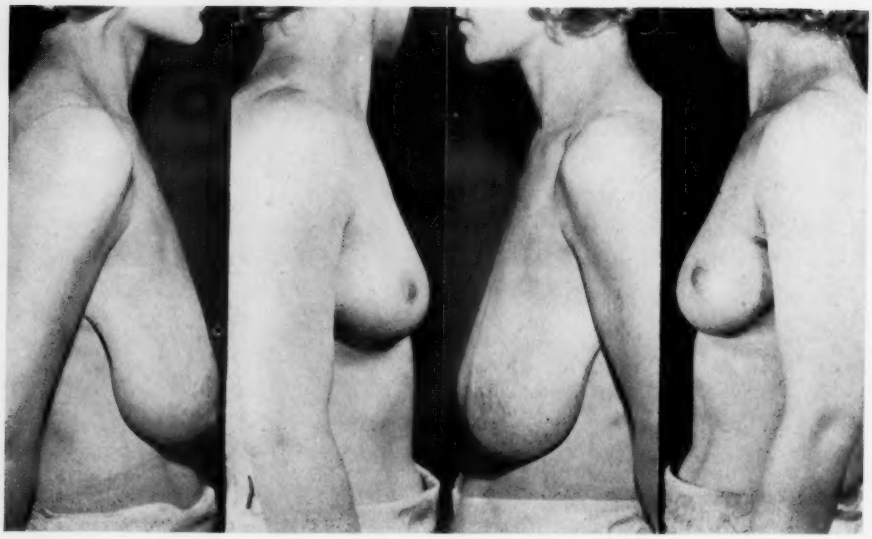

FIG. 5A. FIG. 5B.

FIG. 5A.—Girl, aged twenty-seven, referred in May, 1932, for plastic repair of hypertrophic pendulous breasts extending to a level slightly above the umbilicus. Due to the *symmetry* of the deformity, the outlining of incisions could be made equal on both sides to approach an ideal pattern. The surgical repair was done in two stages. In the first, skin flaps were outlined on both breasts and excessive fat and glandular tissue removed, especially in the lower poles. (Fig. 6, II-J.) The transposed areolæ were sutured at a higher level without undue tension. Interference with the blood supply was avoided by preserving most of the glandular tissue on the lateral sides of the breasts. Three months later the redundant skin and glandular tissue were removed from the external aspect of the breasts through an incision in the submammary folds. (Fig. 6, V-H.)

FIG. 5B.—End-result with the areolar scar scarcely visible and the lower incision concealed in the submammary fold. The satisfactory end-result brought about a great improvement in the physical and mental attitude of the patient.

When the skin covering cannot be provided in its entirety by the anterior flap without producing tension about the nipple, the posterior incision is placed above the submammary fold, thereby making it possible to utilize part of the

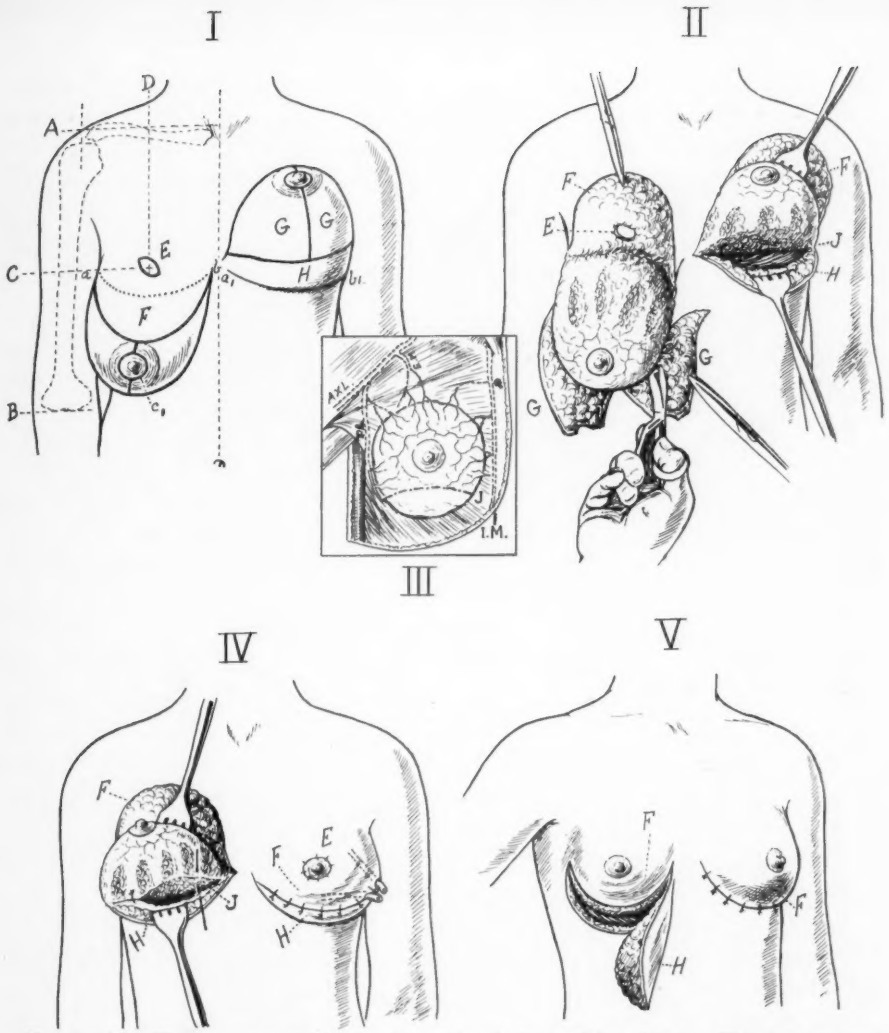

FIG. 6.—(I) The two-stage method in the repair of the pendulous breast. The flaps are outlined in such a way as to bring about the covering of the reduced gland without tension. The first stage consists of the excision of excessive skin and reduction of the fatty and glandular tissue, particularly in the lower pole. The reduced gland and areola are transposed and the latter sutured into a window previously prepared as the new location for the nipple. By making the lower incision above the submammary fold (a, b), additional skin is made available on the posterior aspect of the breast (H), to cover the gland without tension. This reduces the danger of necrosis to a great extent. (A) Horizontal line across the clavicle. (B) Horizontal line through elbow-joint. (C) Horizontal line halfway between A and B. (c_1) Circular incision reducing the size of the areola. (D) Vertical line across the middle of the clavicle. (E) Intersection of C and D which determines the new location of the nipple. (F) Anterior flap, the lower border of which extends to the areola. (G) Excessive skin on lateral and posterior aspect of the breast to be excised. (H) Skin flap above the submammary fold to be sutured to flap F. (a-b) Submammary fold.

(II) Shows denudation of the gland, excision of lateral flaps (G) and removal of fat and glandular tissue from the lower pole (J). This is done only superficially in the upper and lateral quadrants. Note that the blood supply around the reduced nipple is retained.

(III) Shows the main distribution of the blood supply in the breast gland. The thoracic lateral (T L) and external mammary (E M) branches of the axillary (A X L) supplying the serratus anterior muscle and sending perforant branches through to the external portion of the gland and skin. Internal mammary (I M) and perforant branches to the deeper portion of the gland and the skin on the inner third of the breast. (a) Main intercostal artery which passes to the second intercostal space.

(IV) Showing reduced gland after excision of all excessive skin during closure of glandular defect (right breast). Left breast, after transposition of the areola and the suturing of skin flaps H and F.

(V) (Second stage.) Right breast shows removal of excessive skin, fat and glandular tissue by a crescent-shaped excision along the submammary fold. The hypertrophic glandular structures in the external quadrant can now be freely excised without danger of impairing the vitality of the nipple because healing of the latter has been achieved in the first stage. Left breast, final condition after closure of the defect.

skin from the posterior aspect of the breast.[1] The disadvantage of this lies in the fact that the linear scar is then visible under the areola instead of being concealed in the submammary fold. (Fig. 2.) Sometimes a shortage of skin covering makes it necessary to transpose a smaller areola than that of the opposite side. This is a minor imperfection.

Summary.—The most frequent varieties of breast asymmetry are (1) asymmetry due to unilateral hypertrophy, with the opposite side normal; (2) bilateral asymmetrical hypertrophy; (3) asymmetry due to unilateral amastia or micromastia, and (4) asymmetry caused by reversed development of the two breasts. Bilateral asymmetrical hypertrophy is the commonest type and occurs in young girls as well as married women.

The etiological factors are not yet known. Embryonal maldevelopment is to be suspected when malformation is present in the chest-wall, the upper extremity and the organs of reproduction. Disturbances of internal secretion during puberty are probably the cause in a number of instances. Trauma may be a contributing factor in the overdevelopment of the larger breast because of the attempt to conceal the asymmetry by excessive pressure.

The indications for surgical repair depend on the degree of asymmetry and the age of the individual. Unilateral repair is indicated when only one breast is conspicuously enlarged. If the opposite side is also partly deformed, correction should be bilateral. Surgical reconstruction is more elaborate in unilateral than in bilateral symmetrical hypertrophy because of the necessity to make the deformed breast correspond in size and position with the opposite side.

The procedure of choice for the repair of these deformities is transposition of the reduced gland and nipple. Necrosis of the skin and nipple are prevented by avoiding interference with the main blood supply such as results from excessive removal of glandular tissue in one stage, the formation of hematoma or undue tension.

The plastic repair of markedly hypertrophic breasts is best done in two stages to avoid complications and assure a satisfactory cosmetic end-result.

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TUBERCULOSIS OF THE BREAST*

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Until the observations of Sir Astley Cooper[1] in 1829, the human breast was considered as being immune to tuberculosis. Even after this lucid description, tuberculosis of the breast was a much disputed entity and not generally accepted until 1881, when Dubar,[2] by microscopical methods, proved the breast to be subject to tuberculosis.

Compared with the frequency of tuberculosis occurring in the other organs of the body, mammary tuberculosis is apparently a relatively uncommon condition. Out of 2,297 cases of diseases of the breast, Mallory[3] found only 0.6 per cent. to be tuberculous. In the decade between 1904 and 1914, Deaver[4] found only seventy-four proven cases of mammary tuberculosis. Barker,[5] in 1926, found that tuberculosis of the breast occurred once to each fifty cases of carcinoma of the breast.

Tuberculosis of the breast is of course due to the tubercle bacillus. Barker[5] claims that all cases in which the organism was recovered were due to the Bovine type. This, however, has not been studied in a large enough series of cases to draw any definite conclusions. It is interesting to note that, according to Boyd,[6] tuberculosis is common in the udder of the cow.

Trauma does not seem to play a very important rôle as a predisposing cause, as only 7 per cent. of the cases gave any such history. Heredity apparently also plays a minor rôle as a predisposing factor as only 13 per cent. of the cases gave a history of tuberculosis in the family.

Sex is a predisposing factor as out of 399 cases of breast tuberculosis in only fourteen was the breast of a male involved. Age is important as the majority of the cases occur between the twentieth and fortieth years, the period of reproductive activity. Two hundred ninety-four cases were married and 188 had borne children. The youngest case observed was that of a male child six months old and the oldest case was that of a woman aged seventy-three.

There is considerable controversy in regard to the manner in which this disease is contracted. The cases are grouped as primary mammary tuberculosis, in which the only evidence of tuberculosis is in the breast, and as secondary mammary tuberculosis, in which the disease is secondary to an existing tuberculous infection in other organs. Of the 399 cases of mammary tuberculosis on record, 234 were classified as primary, as no other evidence of tuberculosis could be found.

Deaver and MacFarland[7] state that with the exception of the few instances of direct inoculation of the breast, through abraded surfaces of the nipple or skin and possibly

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through the milk ducts, all mammary tuberculosis may be looked upon as a secondary manifestation of the disease.

Gatewood[8] believes that tuberculosis of the breast is similar to tuberculosis of the kidney in that there is usually a primary focus of infection elsewhere in the body whether or not it can be discovered by clinical methods. Morgen[9] states that the majority of investigators hold the most common route of tuberculous infection of the breast is by the blood-stream. He points out that the majority of people are infected with tuberculosis but not diseased, and he believes that through some lowering of local resistance around this area of infection, the organisms are liberated and may infect the breast through a retrograde lymphatic flow or by way of the blood-stream. Nagaskima,[10] however, reports the autopsy findings in thirty-four cases of miliary tuberculosis of the disseminated type in which there was no evidence of tuberculosis in the breasts and he concluded that tuberculous infection of the breast by way of the blood-stream must be extremely rare as in his series the breast was the only organ not diseased. Tuberculous infection of the breast by contiguity is uncommon but may develop from a tuberculous empyema, involving the structures of the chest-wall and eroding into the breast itself.

Pathology.—Tuberculosis of the breast is predominately unilateral, as out out of 399 proven cases only thirteen had bilateral involvement. It occurs with about the same frequency on either side.

The pathology of mammary tuberculosis is best classified as follows: (1) acute miliary tuberculous mastitis; (2) nodular (discrete, disseminated or confluent), tuberculous mastitis; (3) sclerosing tuberculous mastitis; (4) tuberculous mastitis obliterans; (5) various atypical forms.

(1) Acute miliary tuberculous mastitis occurs in conjunction with generalized miliary tuberculosis and has no special surgical significance.

(2) The great majority of the cases of tuberculous mastitis are of the discrete nodular variety. The bacilli lodge in the mammary stroma rather than the ductile or periductile tissue and excite a localized tubercle formation. Daughter tubercles form at the periphery of the original focus and, in time, usually a matter of several months but sometimes longer, a palpable mass is formed. This varies in size but rarely exceeds that of a hen's egg. The process may progress from the discrete nodular type to the nodular disseminated or the nodular confluent type or on to sinus formation. Also, it may become encapsulated and lie quiescent for varying periods of time.

One does not see in the breast the abundant reticulo-endothelial reaction so characteristic of the disease in other organs. There is usually an extensive round-cell infiltration throughout the breast tissue in the region of the lesion and giant cells may be seen.

(3) The sclerosing type of tuberculous mastitis is a very slow progressive lesion and most frequently seen in elderly people. The breast is usually not enlarged and often there is retraction of the nipple due to the large amount of fibrous tissue formed. Sinus formation is rare in this type. Microscopically there is usually seen a diffuse lymphocytic cellular infiltration accompanied by epithelioid and giant cells interspersed with varying amounts of fibrous tissue but with very little caseation.

(4) In the tuberculous mastitis obliterans the lesions seem chiefly to surround the milk ducts, destroying the epithelial linings, and finally obliterating

them. The retained material in the obliterated ducts may excite the formation of foreign-body giant cells. The nipple is sometimes ulcerated away and these cases seem illustrative of a primary ductile infection.

Tuberculosis of the breast is sometimes associated with other diseases of the breast. There are reported ten cases showing adenoma and seventeen cases showing a co-existing carcinoma. In one of these cases there was bilateral breast carcinoma with unilateral mammary tuberculosis.

Symptomatology.—The clinical history of this disease is not characteristic in the primary cases. In the secondary cases the findings elsewhere in the body of tuberculosis lead one to suspect the lesion. In 75 per cent. of cases the first thing noticed by the patient was a painless lump in the breast. Only 6 per cent. had pain for the initial symptom. In the remainder of the cases the first symptom was discharge from the nipple, hardening of the breast or sinus formation.

The physical findings depend upon the type of the disease and the stage. There may be seen anything from a single cystic tumor in the breast to a breast reduced to a mass of puckered skin upon which open many discharging sinuses. In some, there may be a retracted nipple; in others, the skin overlying the tumor may be pulled in or pushed out and may even resemble the pigskin appearance of carcinoma. Upon palpation, the tumor may feel not unlike a malignant one being fixed to the surrounding tissue. It is not encapsulated and the induration of the surrounding tissue may greatly resemble the œdema of the tissues immediately about an area of carcinoma. In the sclerosing type of tuberculosis, one may feel nothing more than the hardened breast parenchyma without any localized lump. If an unruptured abscess is present in the superficial part of the breast, fluctuation may be elicited and in the absence of signs of acute inflammation it cannot be differentiated from a simple cyst.

There is axillary lymph-gland involvement in over 50 per cent. of cases. In general, tuberculosis of the breast runs a more acute course than does carcinoma of the breast though several cases are reported in which the tuberculosis was present in the breast for over five years and one case in which it was present for eighteen years.

Diagnosis.—The diagnosis of tuberculosis of the breast is made upon the history of a painless lump in the breast, slow in growth and in many instances going on to abscess, rupture and sinus formation. The involvement is nearly always unilateral as only 13 out of the 399 proven cases were bilateral. If active tuberculosis is present or has been present elsewhere the diagnosis of mammary tuberculosis is strengthened. When there is only the lump in the breast, chronic cystic mastitis, fibroma, adenoma, papilloma, gumma, sarcoma and carcinoma must be ruled out. The fibro-epithelial tumors and simple cysts will not as a rule excite suspicion of tuberculosis. Gummas may be ruled out by the Wassermann reaction, and by anti-luetic treatment. Sarcomas are very rare in the breast and grow with great rapidity. Pain is usually present and the cutaneous veins over the breast are as a rule greatly dilated. Car-

cinoma may be extremely difficult to differentiate from tuberculosis of the breast. However, tuberculosis usually occurs at a younger age and as a rule runs a more acute course than carcinoma. Even in cases in which there is fluctuation one cannot rule out cancer as this tumor may undergo central softening.

Some cases of tuberculous mastitis of the sclerosing type cannot be differentiated from carcinoma by gross section and one must resort to microscopy. The röntgenograms of the breast will be of aid in diagnosis, although we can find no literature on the röntgenographical findings in mammary tuberculosis. The differential points would probably be somewhat the same as between carcinoma and chronic mastitis. The majority of the reported cases of primary tuberculosis of the breast were misdiagnosed as carcinoma and not until after operation was the presence of tuberculosis suspected. In mammary tuberculosis with sinus formation, simple pyogenic mastitis, degenerated gummas, actinomycosis and carcinoma must be ruled out. Simple pyogenic mastitis usually runs a more acute course than does tuberculous mastitis, though this is not always true. Broken-down gummas may be ruled out by the Wassermann test and by anti-luetic treatment. Actinomycosis is extremely rare and the ray fungus usually can be found in the discharge from the sinuses.

Carcinoma with sinus formation may resemble closely breast tuberculosis. However, as patients are paying more attention to lumps in the breast and are coming to physicians earlier, this stage of cancer is becoming rare. Curettement of the sinuses may disclose tuberculous granulation tissue and the Koch bacillus can sometimes be isolated from the discharge. On all cases of suspicious breast tumors carcinoma should be considered until ruled out. The absolute diagnosis of mammary tuberculosis is made by the microscopical finding of the tuberculous tissue in the lesion or curettings from the sinuses, rarely by the finding of Koch bacillus in stained sections, or the development of tuberculosis in animals inoculated with pus or scrapings from the lesion and more rarely by the finding of the organism in the pus. The tuberculin test is of little value in adults as practically all show a positive reaction.

Treatment.—The treatment of breast tuberculosis is surgical removal of the lesion. There are no cases in which proven breast tuberculosis has undergone a spontaneous regression. Röntgenotherapy perhaps would be efficacious in an early lesion, though we can find no evidence of cases so treated. Some writers advocate simple mastectomy in all cases, while others are more conservative and recommend removal of the involved area only. Radical mastectomy with removal of the pectoral muscles is never necessary unless there is involvement of the chest-wall. The accompanying lymph-node involvement may be removed surgically or may be treated by röntgenotherapy. When mammary tuberculosis is untreated, the disease may attack other organs and cause death.

The prognosis in cases of primary breast tuberculosis with proper treatment is excellent, as the general health of the patients is nearly always good. This is not true of the cases of secondary breast tuberculosis, the prognosis

being guided by the degree of tuberculous involvement in other parts of the body.

CASE I.—White female, aged fifty-nine, a housewife by occupation, was admitted to the Graduate Hospital with an ulcerative lesion on both nipples. The past history was uneventful except for the birth of one child, now living and well, and the removal of a small benign growth from the upper portion of the left breast fourteen years before admission. There was no known contact with tuberculosis in any form.

Physical examination was essentially negative except for the presence of an ulcerative lesion on each nipple. Seven months prior to admission she had first noticed a crusting of both nipples. The lesion on the left breast progressed more rapidly than the one on the right and after several months the surrounding areola became involved. When the crusts were removed there was seen a raw bleeding surface, but there was

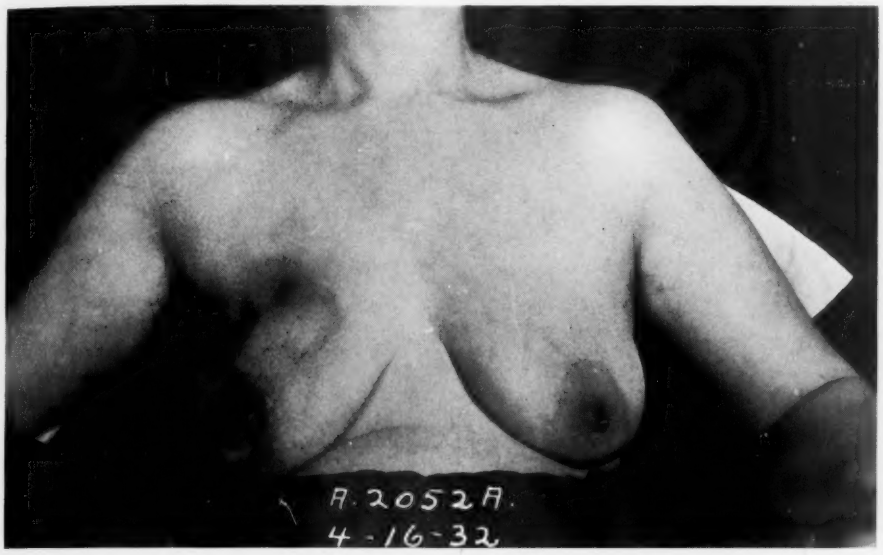

FIG. 1.—(CASE II.) Photograph before operation showing large tumor in upper right breast with retraction of the nipple.

never any active discharge from either nipple. There was a small area of induration beneath each nipple, more on the left than the right. No other pathology could be felt in either breast and the axillary lymph-glands were not enlarged.

Röntgenogram of chest showed an old organized lesion in the right upper lobe which was thought to be an old healed tuberculous process. Röntgenogram of the breasts showed a small area of density beneath each nipple, more on the left than on the right.

The pre-operative diagnosis was Paget's disease of nipples and both breasts were removed by Dr. Walter Estell Lee. Dr. E. A. Case reported both breasts to be tuberculous, the only involvement being a small area just beneath each nipple. Sputum was examined on six occasions and one guinea-pig was inoculated with sputum and no tubercle bacilli were found.

The patient made an uneventful recovery and six months after operation was in good condition with no evidence of recurrence of her tuberculous infection. This case would appear to be one of primary bilateral tuberculosis of the breasts, gaining entrance by way of the milk ducts.

CASE II.—White female, aged thirty-four, a housewife by occupation, was admitted to the Graduate Hospital with a tumor in the right breast. Her past history was un-

eventful except for the birth of two children, two and five years previously. There had never been any known contact with tuberculosis. One week before admission she had first noticed a painless lump in the upper part of the right breast. There were several enlarged lymph-glands in the right axilla. The breast tumor (Fig. 1) measured 6 cc. in diameter and appeared to be nodular and infiltrating in character. There was no attachment to the chest-wall, but the attachment to the skin and the upper part of the nipple made it appear to be retracted. The lesion had none of the appearances of being inflammatory and was only slightly tender on palpation. There was never any discharge from the nipple. Röntgenogram of the breasts (Fig. 2) gave evidence

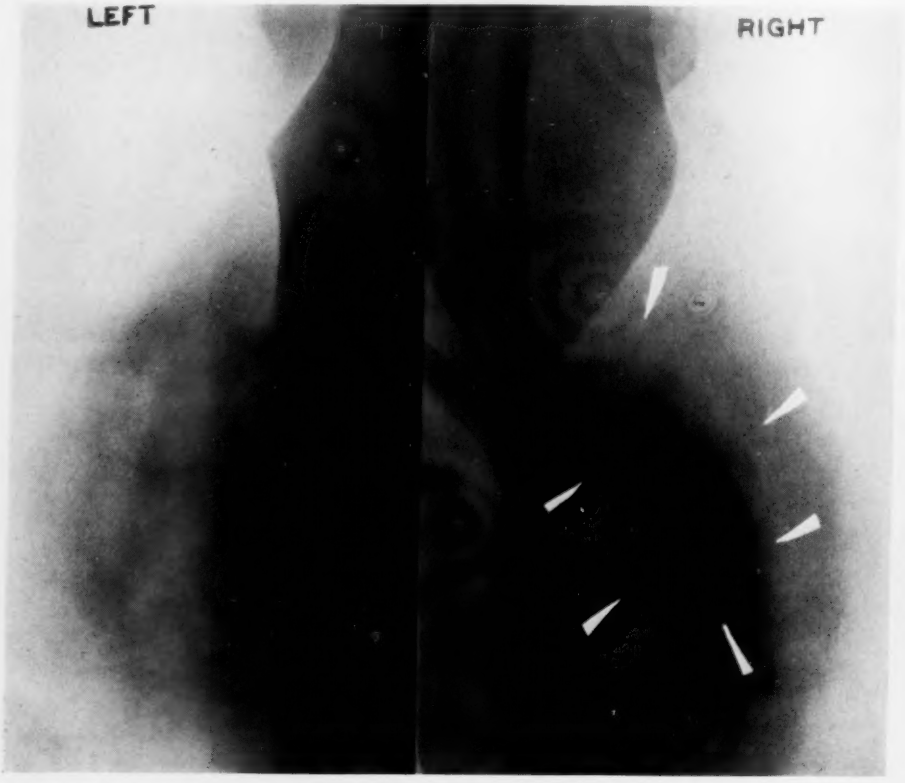

FIG. 2.—Left breast normal. Note the regular striations extending downward from the nipple toward the base of the breast.

FIG. 3.—Right breast shows a general enlargement as compared with the left. The films were made under like conditions. There is a general dense area with a central portion which is specially dense. This is not sharply defined as occurs in a cyst, but radiates gradually into the surrounding tissue which led to the röntgenological diagnosis of carcinoma, but in review, December 5, 1933, one can recognize that there is a base line located about 3/8 inch to 1/2 inch from the chest wall, which should always make one think of a non-malignant lesion, for the carcinomas break through this base line.

of an infiltrating tumor which did not appear to be encapsulated and seemed definitely invasive in character. Röntgenogram of the chest as well as other routine laboratory studies were all negative for disease.

A diagnosis of carcinoma of the breast with involvement of the axillary lymph-glands was made and operation advised. Operation was refused and under the direction of Dr. George E. Pfahler radium needles were placed in and around the lesion (Fig. 3) and röntgenotherapy was given to the point of maximum skin tolerance. This therapy covered a period of three months and at the end of this time the lesion had become very painful and had increased in size, not responding to massive irradiation as does the usual

breast carcinoma. Operation, again urgently advised, was accepted and the patient returned to Dr. W. L. Estes, of Bethlehem, Pa., who performed a radical mastectomy on the involved side. The pathological examination, made by Dr. Henry Rothrock and confirmed by Dr. E. A. Case, was tuberculosis of the breast and axillary lymph-glands.

The patient made an uneventful recovery from the operation and has been quite well since. This would appear to be a case of primary mammary tuberculosis as no other evidence of tuberculosis could be found.

CASE III.—Negress, aged thirty-three, a housewife by occupation, was admitted to the Graduate Hospital with painful masses and discharging sinuses in the left breast and axilla. The past history was not significant except for the birth of one child now living and well and the fact that she had never been in contact with tuberculosis.

One year before admission she first noticed two small painless lumps in the left axilla. About two months later these lumps began to enlarge, became painful and the left breast began to enlarge. Several months before admission three sinuses appeared, one in the upper outer quadrant of the left breast, one in the axilla and one between the breast and axilla. She was well nourished and the only evidence of disease was an indurated tender area extending from the upper part of the left breast to the axilla. Three sinuses were present and large amounts of brownish-gray pus was being discharged.

Röntgenogram of the chest showed an old fibrotic lesion in the apex of the right lung which was thought to be healed tuberculosis. Cultures from the breast showed *Staphylococcus albus*. A diagnosis was made of chronic suppurative mastitis and axillary lymphadenitis. Dr. Wm. Bates removed the indurated sinus-bearing area in the breast and the indurated sinus-bearing area in the axilla. The wound was partially closed with adequate drainage.

The pathological examination of the specimen by Dr. E. A. Case was tuberculosis of the breast and axillary lymph-glands. The patient left the hospital on the eighteenth post-operative day with a small draining sinus and in good condition. The wound was treated for several months in the out-patient department but failed to heal and a second operation was advised. The patient refused and shortly afterward left the city and further records could not be obtained. This case would appear to be one of mammary tuberculosis with sinus formation secondary to tuberculosis of the axillary lymph-glands.

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VALUE OF NEPHROLYSIS, URETEROLYSIS AND NEPHROPEXY IN SELECTED CASES *

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As the gradually unfolding picture of our modern conceptions of renal pathology, with its surgery, becomes clearer to us, certain facts stand out in bold relief as playing very essential parts in the problems presented. One of the most evident of these is the part played by soil preparation; by which we infer that certain changes from the normal are existent and by their mere existence invite pathological sequelæ. One of the most frequently abnormal states to be recognized is faulty drainage, and a large group of pathological conditions are today gathered under this one heading and called the obstructive uropathies or, in the subject at hand, the obstructive nephropathies. Today rather than say that this kidney is pathological because of the presence of an infection, we should say that this kidney is diseased because it was primarily anomalous, or because its drainage was faulty. Perhaps chronic pyelitic infection illustrates the point in question. Everyone recognizes the occurrence of an acute pyelitis and, by such, accepts the clinical picture of an acute infectious process that runs its course and terminates—as all such self-limited infectious processes do—with a complete return to normal; but the chronic pyelitis, with recurring acute exacerbations that never completely clear up, is the one where some form of perverted function, faulty drainage, or abnormal renal anatomy has prepared a soil which, once infected, is incapable of ever again regaining its normalcy. Helmholtz, in his studies on chronic pyelitis, was able to prove the existence of a renal anomaly in one out of every three cases, while Roscher found 2.6 per cent. of renal anomalies in 5,527 autopsies.

Similarly, the pathogenesis of renal calculus, in certain of its phases, is approaching an appreciation of the part played by soil preparation in its occurrence and especially in its re-occurrence.

These two conditions, chronic infection and stone formation, when observed in the lower urinary tract, are acceptable proof today of faulty bladder functioning, and are looked upon as symptoms of obstruction and no longer as disease entities. Does it not behoove us to transport this concept to the upper urinary tract and, by so doing, approach its problems along lines of acceptable and proven pathological reasoning?

We are presenting for your consideration forty-six selected cases of renal pathology, in each of which some form of unilateral obstructive nephropathy existed at the time of operation. It might have been proper to entitle this presentation under the older term of hydronephrosis, for,

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with but one exception, all the cases presented the picture of this condition; but the purport of this presentation is to leave this clinical approach, with its clinical diagnosis, and to present the picture from the point of view of the fundamental underlying cause, for in the rectification of such basic pathology lies the successful surgical approach and successful surgical handling.

We have purposely excluded the cases of calculus obstruction, as the hydrodynamics of this condition are readily appreciated and generally understood.

These forty-six cases will be discussed under the following headings: (*a*) pathogenesis; (*b*) symptomatology; (*c*) diagnosis; (*d*) results; and (*e*) treatment.

Pathogenesis.—In thirty-six of the patients the operative lesion was on the right side; in one it was bilateral; and of the remaining nine cases, the lesion was in the left kidney. Two were in a solitary kidney, the other having been previously sacrificed. This prevalence of right-sided pathology, especially evident in renal ptosis, or acquired renal dystopia, has ofttimes been recorded and reasons for its occurrence surmised; yet so far we have not received a satisfactory explanation on which all can agree. The normal lower position of the right kidney, the presence of the liver above, the greater mobility of the hepatic flexure as compared with the splenic flexure of the colon, the greater muscular exertion in the right-handed, the proximity of appendiceal infections, and the part the physiological function of pregnancy plays, are all probable factors in selected cases and can be potential factors in the unilateral soil preparation.

The pathological lesions found to explain the cause of symptoms and signs in this series were as follows: In nine cases aberrant lower polar vessels were the cause of the obstructive nephropathy. In twenty-two cases acquired renal dystopia was at fault. In thirteen patients a peri-ureteritis was present; while in the remaining two cases a true stricture, or submucous fibrosis, was present at the ureteropelvic junction.

Anomalies.—In seventeen of these forty-six cases true renal anomalies were demonstrable. Some were anomalies of position, as faulty ascent or rotation; others anomalies of form, such as the pancake or disk kidney; while others presented true anatomical anomalies, such as varying degrees of bifid pelves and ureters, or true anomalous blood vessels.

It is interesting to record these anomalies though difficult to faithfully ascribe to them their true rôle in the obstructive nephropathy. However, in nine cases accessory aberrant lower polar vessels were demonstrated and adjudged to be the active obstructing factor. The *post hoc, propter hoc* argument, as regards the finding of an aberrant lower polar vessel, is not always acceptable proof of its being the primary obstructing factor. The cases with accessory lower polar vessels seem properly to be divided into four groups:

(*a*) First are those congenitally obstructive from infancy, such as the case recently reported by Verliac, and also in one of our series. Our case was a lad of eighteen years, who had no recollection of ever being free of a constant left loin ache. It was present from earliest childhood and verified by his parents. Nausea and vomiting were the only clinical symptoms, and there were no urinary symptoms and no urinary infection.

(*b*) Secondly are those cases where the obstruction from accessory vessels develops only as growth and puberty change the dynamics of the urinary excretion. We had two such cases, and both again were males. Of the nine cases we have reason to believe that symptoms probably dated from early adolescence in five of them. Both of the above types are prone to have incomplete ascent of the kidney, or incomplete rotation, and it is easy at operation to demonstrate the pathogenesis. The silence of these lesions for any active urological symptoms, or signs, accounts for the ordinary delay in their recognition. Gastro-intestinal disturbances are the rule and absorb the practitioner's attention. Yet in their early stages these cases represent in its purest form the *potentially dysuric kidney*, whose early surgical rectification is essentially demanded if the organ is to be saved. If left alone, they constitute the most ideal soil preparation for infection or stone formation, which at once introduces a complication much to be feared.

(*c*) In the third group the existence of an anomalous vessel has been of no importance until a secondary factor, such as trauma, ptosis or the pelvic distention associated with pregnancy, brings its obstructive powers into play, from which time anomalous vessel, obstruction and hydronephrosis become interacting, self-perpetuating and increasing. This is probably the most usual type in surgical experience.

(*d*) The fourth group includes those in which, though aberrant vessels are present, they play no part in the obstructive nephropathy.

It is of especial interest that in these nine cases, where anomalous vessels were adjudged the cause of the obstruction, in only one of them was the kidney a true third-degree dystopia, and in only two others was a second-degree dystopia found. Yet of these nine cases seven presented large hydronephroses, one a moderate hydronephrosis in a pancake kidney and one slight hydronephrosis with pain and hæmaturia. In the entire study of forty-six cases, in forty-two of whom hydronephrosis was present, there were eleven in whom no actual ptosis occurred, and six of these were cases of aberrant vessels. This is rather strong evidence of the part played by such anomalies and is a diagnostic point in certain cases in explaining pre-operatively the reason for hydronephrosis in the absence of demonstrable ptosis. There appears to be necessary in these cases but a very slight change in renal position for the aberrant vessel to begin to cause obstruction. Of the nine cases with aberrant vessels two were infected; one practically destroyed kidney was removed; the other has been temporarily saved; the remaining

sterile cases (seven) were treated by severance of the anomalous vessel and nephropexy.

Ptosis.—Renal ptosis was present in all but eleven of the forty-six patients, but in twenty-two of the series it was judged the sole cause of the obstruction. The relationship between such renal dystopia and obstructive nephropathy is well recognized, though a constant reminder must be observed of the frequency of this condition in the absence of symptoms. The oft-quoted figures of Dr. Hector MacKenzie that, of every 100 women, twenty will have ptotic kidneys, but only four will have symptoms therefrom, have been frequently corroborated. During the past four years, since we have been able to study the entire dynamics of the urinary tract by intravenous urography and thusly visualize the same in varying intervals of time and changes of position, undisturbed by the artifacts of cystoscopical instrumentation, it has been intensely interesting to observe the great number of patients with very evident renal ptosis but in whom acceptable evidences of obstruction have been absent.

Similarly of interest have been those cases of bilateral ptosis and unilateral symptomatology, and these are some of the facts that again bring home the realization of the necessity of further anomalies in order that such dystopias become symptom-producing. From studying these cases, I am convinced that the relationship between ptosis, pain and hydronephrosis is purely individualistic, for symptoms are often long existent before hydronephrotic dilatation is demonstrable. This may be due to the fact that one person lies down and gains relief sooner in each attack than another person, and hence the reiterated renal insult is lessened, though symptoms continue recurrently. Another point recently brought out by Rose is the difference in subjective symptoms, according to whether the hydronephrotic pelvis is intra- or extrarenal, and it is expected that the intrarenal pelvis produces pain in excess of the hydronephrosis, while the extrarenal pelvis is frequently to be found of astonishing size but presenting minimal symptoms.

There were twenty-two cases of simple renal dystopia; one palpable, nine movable and twelve floating, if we adopt Kelly's classification. Each presented acceptable evidence that the dystopia alone was responsible for the hydronephrosis and the symptoms therefrom. In only one of these cases was a chronic infection present, as likewise a soft renal calculus, which latter was undoubtedly secondary to the stasis and infection, and its removal, when drainage was established, was but a step in the proper handling of the surgical problem. This patient (a male) has gained forty pounds in weight and is working, but there has been a disappointing return of his renal function, and stasis has not been entirely relieved. One other case with third-degree dystopia was associated with a large pelvic neoplasm, and as both lesions were diagnosed pre-operatively, nephrectomy was performed. The remaining twenty cases presented eleven third-degree dystopias

and nine of second-degree dys[illegible]. In each of these the dystopia alone appeared to be the cause of tl[illegible]ymptomatology. Each was free of infection, and the results of nephr[illegible]ysis, ureterolysis and nephropexy have been especially satisfactory in this group, for we have sixteen cures to report in this group of twenty patien[illegible].

Peri-ureteritis.—The third most prominent cause of the obstruction in this series was peri-ureteral and peripelvic adhesions, and in thirteen cases it was considered to be the factor responsible. This is a most interesting goup as it is not necessary to have a true urinary infection present. In fact, five [illegible]f these cases were devoid of infection at their pre-operative study. Yet at operation one finds dense connective-tissue changes, associated with fixation, angulation, kinking or immobility of the ureter. This leaves little doubt but that this lesion must be associated with some form of low-grade chronic infection of a purely local character. Twice we have seen this associated with a retrocecal appendicitis and in one instance so diagnosed the condition pre-operatively. Today we believe one is justified, in all such cases, in performing an intraperitoneal exploration of the appendix as a step in the operation, which of course should be done before the urinary tract has been actually opened.

In five of these cases the upper ureter, the ureteropelvic junction and the hydronephrotic pelvis were found so densely encased that, to perform a satisfactory ureterolysis, these structures had to be stripped out, or circumcized from their embrasure before normal relations were again established. The possibility that these dense fascial sheaths may represent vestigial remains of prerenal organs and are hence of congenital origin is an interesting thought to dwell upon as to their etiology.

Varying lesser degrees of inflammatory peri-ureteritis were responsible in eight patients, and observations were made on some of these where angulations by almost insignificant bands were freed to immediately observe active peristaltic waves pass successively down and rapidly empty the distended pelvis. In only two patients was nephrectomy necessary, in both of whom massive pyonephrosis existed.

Submucous Fibrosis.—The remaining two cases have been classified as true ureteral stricture, and in each case it was situated at the ureteropelvic junction. One was without infection, with only a first-degree ptosis, but a large hydronephrosis, while the other was infected, with a second-degree ptosis and a large hydronephrosis. The former was handled by a ureteropelvic pyeloplasty, in addition to the ureterolysis, nephrolysis and nephropexy; the infected case had to be nephrectomized as the condition was of eight years' standing.

Symptomatology.—Of outstanding importance in the clinical interpretation of these cases is the appreciation of the fact that true urinary symptoms are often conspicuous by their absence. Where infection is not present, neither symptoms nor signs attract the patient's attention to the urinary

apparatus, and hence the physician is misled from the very outset. The frequently repeated story is that, after a varying period of months and years, of fruitless therapeutic endeavor, a transitory hæmaturia was the first symptom that focused attention on the true location of trouble. Hæmaturia was recorded as a symptom at the time of the first urological consultation in one-third of our patients. Nausea and vomiting were outstanding symptoms in sixteen patients, some of whom had cultivated the habit of willful vomiting in order to gain relief after eating. Ten were markedly constipated. Fifteen of these forty-six cases had had a previous abdominal operation, and nine of them had had more than one such. In this series thirteen patients referred all their symptoms to the gastro-intestinal tract. In twenty-two patients a dull ache in the loin or lower right or left quadrant was present and drew attention to the possible renal or ureteral condition. Fifteen had suffered true renal colic, and seven were to varying degrees dependent upon morphia. Dysuria in fourteen and urinary frequency in twelve of them comprise the only outstanding urinary evidence. Vague backache was complained of by fifteen, pain in the iliac regions by twelve, while nine had themselves noticed an abdominal mass. An increase in all symptoms at time of menstruation is another misleading but frequent observation.

As symptoms of complaint, one must interpret the story of unilateral dragging, discomfort, gastric distress that passes through all the phases of indigestion to active attacks of nausea and vomiting, but one should look with discredit on any one who is not rather promptly improved or relieved by recumbency. One naturally becomes wary of the confirmed neurasthenic with multiple abdominal scars, who enjoys being the family invalid. Our present-day methods of investigation, when properly handled and intelligently interpreted and analyzed, should rarely allow such a one to slip through to another operative procedure, though I fear we have all been fooled a time or two in the past.

Diagnosis.—It seems beyond a doubt that a keener appreciation of urographical study, an accumulating knowledge of röntgenographical interpretation, and a better understanding of the dynamics of the excretion of urine are responsible for a rebirth of interest in this subject. With the advent of the modern intravenous method of urography came a positive means of determining faulty function and a secondary means of studying post-operative results. Intravenous urography, now four years old, has carried this field of diagnosis, good as it was before, marvelously farther towards perfection. Today, without the disturbing influences of instrumentation, we are able to picture the complete physiological functioning of the excretory urinary channels. The dynamics are pictured with time and opportunity to vary position or focus, to check or double check any uncertain aspects, and later to gain post-operative knowledge of results without subjecting a patient to cystoscopy. Cystoscopical pyelography is neverthe-

less a court of arbitration, and in this series it was utilized wherever it seemed indicated.

The method of intravenous urography is so simple, so valuable and so harmless that we wish to urge that it be included in the routine study of every abdominal case where the time element can be safely spared. Accurate and proper interpretation of the plates so obtained is of course an absolute essential, but a pit-fall into which it is easy to make a misstep.

Today the diagnosis of every case of obstructive nephropathy is obtained from these evidences *with but one exception.* This one exception we consider of the foremost importance, and it is the ability to reproduce the symptoms of complaint on artificial distentions of the renal pelvis that is under suspicion. Such is not to be elicited by a careless leading question that any neurasthenic would bite on; but the accuracy with which a true case can be made to experience a typical attack—be the symptoms what or where they may—is a diagnostic asset of the very utmost value.

Another point of interest was the small number (twelve, or 26 per cent.) that presented the classical picture of a long, thin body with flat chest and narrow subcostal angle. The patient with poor abdominal musculature was also in the minority. So these two features, so often quoted to make one suspicious of acquired renal dystopia, though unquestionably related, are by no means a necessity. Only once have we obtained that other classical diagnostic point of sudden bladder filling at periodic intervals or with change of posture. The average age in this series is thirty-four and a half years, the oldest sixty-one years and the youngest seventeen years.

One thing further should be emphasized. To date we are unfortunately seeing extremely late manifestations of the conditions portrayed. The effort should be made, in every branch of surgery, to permit corrective operative procedures early. It is truly remarkable to observe the rapidity with which the renal pelvis attempts to return to normal when once satisfactory drainage is established. We should not have to wait (as unfortunately has been advised by some), until gross evidence of hydronephrosis is present to diagnose and advise corrective treatment. We should be prepared to recognize the condition without waiting for the development of pathological results. It is essential that the potential dysuric kidney be early recognized and corrected, rather than ask for the uncertain return of a third-degree hydronephrosis.

Results.—In nine patients nephrectomy was necessary. One had a complicating pyelitic tumor. One was a congenital condition and the kidney functionless. Five had suffered from six months to eight years, were chronically infected, with marked renal destruction, and the outlook was not worthy of a trial to save the organ. Another had an acute infection of a congenital hydronephrosis. In the last case an economic pressure demanded as prompt a return to health as was surgically possible, and we bowed to such necessity where again the outlook was none too promising.

In three others secondary nephrectomy is threatened. In one a ureter

was severed and reimplanted in order to save an aberrant inferior polar vessel. Symptom-free, he nevertheless has had a poor result on follow-up functional and urographical studies. The second is a woman whose home life is wretchedly unhappy and unquestionably arduous. Possibly she returned to work and trouble too soon, but she has still a continuation of painful symptoms and has not been able to allow us a follow-up study. The third, infected and with a soft stone, was an early case, and today I would say that we did not do enough and did not drain properly.

The remaining thirty-four where nephrolysis, ureterolysis and nephropexy were performed, we can classify as twenty-six complete recoveries, three with partial recovery and five awaiting our six-months' period of post-operative follow-up examination. In two cases with good recovery the solitary remaining kidney was the seat of the operation, its mate having been removed in earlier years. Of the nine cases of aberrant polar vessels eight were severed in order to obtain a complete ureterolysis. There have been no ill effects in either immediate or late post-operative recovery in them.

There were eleven cases of badly infected pelves. Five were nephrectomized and six subjected to ureterolysis, nephrolysis and nephropexy, with added temporary pelvic drainage, with five good results and one poor, and this latter the one referred to above of ureteroneostomy. There has been one late post-operative death, due to chronic interstitial nephritis, substantiated at autopsy study.

Treatment.—The operation that we have used has always been varied to meet the individual problems but with basic steps required in all.

The ureter is generally first exposed and carefully studied as it approaches its kidney in an effort to trace upward from normal ureter to the point of possible blockage. This area, if found, is carefully dissected to determine cause and effect and outline a mode of corrective surgery. Polar vessels are ordinarily sacrificed, adhesions are completely removed, and in the cases of stricture at the ureteropelvic junction a pyeloplasty of generous dimensions has given us our best results.

The kidney is then completely exposed and thoroughly cleaned of all adherent perirenal fat and fascia. The step is carried to include pelvis and pedicle vessels, so that in the end your completely cleaned kidney, pelvis and ureter are free of all encumbrances, but this must be accomplished by delicacy of handling and never by undue roughness.

If infection is present, the pelvis is buttonholed and a curved lithotomy forcep passed into the inferior calyx and out through the cortex on the renal periphery and, by its aid, a catheter drainage tube pulled into the pelvis. The step is almost bloodless, and one can choose the point for perforation where the cortex is especially thin and drainage will be best accomplished. The tube is ordinarily large enough to put the walls of the punctured tract on tension, and hence the lack of either bleeding or the necessity for any stitching.

The upper posterior face of the kidney is then decapsulated and the capsule folded downward, so that the two fixation stitches then placed on the posterior face of the lower pole have the added strength of this capsular tissue in preventing their cutting out.

The renal fossa is next prepared by stripping all fat and fascia from its posterior wall, shoving the same medianward.

Next the kidney is fitted to its new (or old) bed, and the traction stitches are so placed in relation to lower ribs, the arcuate ligament, or quadratus muscle as to allow a free play to the ureter and a little tilting outward of the lower pole. Ordinarily two-thirds of the kidney are placed above the edge of the lowest rib when fixation is finished and sutures tied. The table is then flattened, the work and the ureter again inspected, and closure made in layers, with or without drainage as indicated.

The patient is nursed on her back for two weeks, during which time the foot of the bed is elevated ten inches, and a third week in bed is varied by moderate turning but with competent abdominal support.

In summary let us accentuate the following points:

(1) The urological examination of all non-acute abdominal cases; *i.e.*, an intravenous urographical study.

(2) Investigation of the appendix where peri-ureteritis is present.

(3) Drainage in infected cases by nephrostomy in addition to nephropexy and ureterolysis.

(4) The realization that one should not have to await the development of hydronephrosis before being able to diagnose its incipiency and recognize the potentially dysuric kidney.

(5) Corrective surgery must be, perforce, early surgery.

PRIMARY TUMORS OF THE URETER WITH SPECIAL REFERENCE TO THE MALIGNANT TUMORS

REPORT OF THREE CASES

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Primary tumors of the ureter fall into two main groups, namely: epithelial tumors and non-epithelial neoplasms, or those arising from structures other than the mucous membrane of the ureteral wall. The epithelial tumors may be subdivided into the papillomata, the papillary carcinomata and the non-papillary carcinomata. This report will deal chiefly with the carcinomatous tumors of the ureteral wall.

Papilloma.—The benign papilloma may occur singly or in groups which at times may fill the entire ureteral lumen. It is strictly a mucous membrane growth made up of villæ, each one of which has a core consisting of fibrous tissue which contains a small vessel, the entire core being surrounded by a layer of columnar epithelium (papillary-fibro-epithelioma). It is in all respects identical with the bladder papilloma. Although the consensus of opinion is that papillomata are true tumors, Stoerk[1] maintains that the papilloma represents the product of a chronic inflammation, a true hyperplasia, resulting from mucous membrane irritation similar to that which occurs in the larynx, gall-bladder or intestine.

Papillary Carcinoma.—Although these tumors outwardly resemble the benign papillomata, and do, in fact, frequently arise from them, a careful study shows that the individual papilla of the malignant tumor is thick and club-like, and in addition the tumor is attached to the ureteral wall by a broad pedicle. While the benign papilloma displays a great tendency to occur multiply, the malignant tumor usually remains single. The microscopical criteria of malignant cells with their tendency to invade the stalk are features which are sufficient to differentiate the malignant from the benign tumor. The papillary carcinoma shows a definite tendency to metastasize and invade adjacent structures. Metastases to regional and retroperitoneal lymph-nodes have occurred in 48.1 per cent. of the series here to be reported, while metastases to distant organs such as the liver and the lung (22.2 per cent. and 18.5 per cent., respectively) are not uncommon. The tumors are usually situated in the lower or pelvic portion of the ureter and as a result of their tendency to occlude the ureteral lumen are frequently associated with hydronephrosis and hydro-ureter.

Non-papillary Carcinoma.—The non-papillary group of carcinomata represented by adeno-carcinoma, carcinoma-solidum, medullary-carcinoma, encephaloid-carcinoma, scirrhous- and squamous-cell carcinomata, constitute about 42 per cent. of all the malignant growths of the ureter. A few cases

have been reported where the tumors were mixed, as in the case of Adler[2] where there was a combination of squamous and papillary carcinoma, and the case of VorPahl[3] where the tumor at the ureteral orifice consisted of medullary carcinoma and that found in the mid-portion of the ureter of scirrhous carcinoma. The squamous-cell tumors are frequently associated with calculi or with other types of inflammatory lesions. Aschner's[4] case, for example, was associated with leucoplakia of the surrounding ureteral mucosa. Similar association between cancer and calculus is seen in the gall-bladder. Judd and Struthers[5] maintain that this combination is present in 16 per cent. of all cases, while Kretschmer[6] found only five cases associated with calculus. Our studies indicated only ten instances of ureteral calculi in a collected series of sixty-eight cases of carcinoma of the ureter, including three cases of the author, an incidence of 14.7 per cent. The literature indicates two cases associated with anomalies of the ureter, one by Neelson,[7] in which there was a forking of the ureter with a double pelvis, and the other by Jona,[8] in which the tumor occurred in a sort of diverticulum of the ureter. In one of the cases (Case 1) reported by the author, there was a double ureter.

Incidence.—Primary carcinoma of the ureter was first reported by Rayer,[9] in 1841. It was not until forty-three years later that the first report of such a tumor appeared in English by R. Davy.[10]

Women are affected almost as frequently as men (32:36). The greatest incidence of carcinoma of the ureter occurs in the sixth and seventh decades. Out of sixty-eight cases, fifty-one occurred between fifty and eighty years of age. The oldest patient was a female, eighty-nine years of age, reported by Toupet and Gueniot,[11] and the youngest thirty-five (one case by Finsterer[12] and the other by Hofmann[13]). About half of the reported cases occurred in the lower part of the ureter. The right ureter was affected almost as often as the left (32:33), three reporters failing to mention the side involved.

Symptomatology.—There are no symptoms sufficiently characterisic to differentiate a benign from a malignant growth of the ureter. In fact, it is almost impossible from symptoms alone to ascertain whether the lesion is in the ureter or in the corresponding kidney. Pain, hæmaturia and tumor constitute the triad of symptoms suggestive of this disease. And yet, all three of these symptoms are not always present in any given case. Hæmaturia is by far the outstanding, and often the earliest, symptom of malignant tumor of the ureter, being present in 75 per cent. of the cases collected in this series. In fact, it may be the only symptom as in the cases of Albarran,[15] Suter[14] and others. On the other hand, hæmaturia may be entirely absent (Wising and Blix,[16] Toupet and Gueniot,[11] and others). The hæmaturia is usually profuse, intermittent and unaccompanied by pain, although colic may occur as a result of the passage of clots through the ureter. It is not at all infrequent to recover small worm-like clots from the urine passed in such cases. (Jona[8].) Hæmaturia of ureteral origin does not differ from that seen when the source of the bleeding is in the kidney.

Meeker and McCarthy[17] have shown in their case that pain may consti-

tute the only symptom in carcinoma of the ureter. A careful study of our statistics referable to this symptom reveals the fact that 45.5 per cent. of the patients complained of renal pain, 5.8 per cent. complained of abdominal pain and 8.7 per cent. gave backache as one of the symptoms. In cases where pain is not due to the passage of blood-clots it results from retention of urine due to the partial or complete occlusion of the ureteral lumen by the growth. Occasionally, the pain is attributable to the concomitant existence of a ureteral calculus (Metcalf and Safford,[18] Paschkis,[19] and others). There is another type of pain which is due to pressure or invasion of the tumor upon adjoining structures, in which event the pain usually radiates to the abdomen, pelvis or perineum. Sciatica was complained of by Israel's[20] patient as a result of the pressure by the tumor upon the sacral plexus.

In every type of ureteral tumor, benign or malignant, there occurs during some stage of its growth an obstruction to the flow of urine from the corresponding kidney which leads to retention of urine and to a dilatation of the ureter and renal pelvis, and eventually to hydronephrosis and hydro-ureter. It is the hydronephrotic kidney which is readily palpated in the flank and often designated as a tumor; as was recorded in 35.2 per cent. of the collected cases in this series, although a survey of the pathological specimens recovered by operation or autopsy disclosed an incidence of hydronephrosis of 67.6 per cent. indicating thereby that although this condition is present very frequently, it is noted in the course of physical examinations in only slightly more than half of the cases. In those cases where hydronephrosis was not present, it was due to the fact that the tumor either remained small or was situated at the ureteral orifice and showed a tendency to grow into the bladder rather than into the ureteral lumen as was noted in the cases reported by Finsterer, Chiari[21] and Hofmann.[13] In certain well-advanced cases (Butler,[22] Paschkis and Pleschner[58] and others), it is at times possible to feel the actual ureter tumor through the abdominal wall, rectum or per vaginam, and in the case of the latter may be mistaken for adnexal neoplasm (Albarran,[15] Israel[20]).

Diagnosis.—A survey of Table VI indicates that only twenty-two cases including three of the writer's an incidence of 32.3 per cent., were diagnosed as tumors of the ureter, and four additional cases as probable tumors of the ureter, leaving about 62 per cent. of the cases where this lesion was not even suspected. It is also of interest to note that up to about 1915 most of the diagnoses were made at post-mortem. Gerstein,[23] in 1902, was the first to diagnose the condition clinically, and, in 1912, Chevassu and Mock[24] also made a clinical diagnosis of ureteral tumor. Chiari[21] noted the possibility of such a lesion in 1914, while Neelson,[7] one year later, made a correct pre-operative diagnosis. Since then, with the use of the more modern procedures in urological study, the incidence of correct pre-operative diagnosis becomes more marked. In other words, it is quite evident that it is exceedingly difficult to make the diagnosis from symptoms and physical signs alone. Given the three cardinal symptoms, namely: hæmaturia, pain and tumor, one must

suspect calculus, inflammation or tumor. X-ray usually suffices to rule out stone. At times, finding of atypical cells in the centrifuged specimen of urine, or even of papillary-like tissue, may arouse suspicion of tumor as in the case of Krafft.[26]

It is upon cystoscopy and the various allied procedures associated with it that we must depend to make the diagnosis of ureteral tumors. Through the observation telescope blood may be seen coming through one ureteral orifice (17.3 per cent.) or a papillary excrescence may present at a ureteral meatus (29.4 per cent.). Blum[27] was the first to describe a case in which, during the ureteral systole, a papillary tumor appeared through the meatus only to disappear again during diastole. This same condition was found by Caporale.[28] E. Wassidlo described a case in which a papillary tumor presenting at the ureteral orifice grew larger with the expulsion of urine from the ureteral meatus.

One of the most helpful diagnostic methods is the passage of the ureteral catheter. An obstruction is frequently encountered at the site of the tumor (38.2 per cent.). This in itself is not of diagnostic importance, but the provocation of bleeding following the manipulation of the catheter at the site of the obstruction is definitely significant. Beer[29] commented upon the nature of the bleeding in such cases by stating that where the obstruction is due to a tumor the blood, instead of dropping out of the end of the catheter intermittently, drops out continuously. Krafft[26] suggested massaging of the ureter to evoke bleeding in cases of suspected ureteral neoplasms. This observation was confirmed by Gottlieb.[30]

A filling defect in the ureterogram is of great diagnostic importance (Crance and Knickerbocker,[31] D'Aunoy and Zoeller,[32] Scheele,[33] author). However, this procedure cannot always be carried out since in deep-seated and infiltrating tumors the fluid medium cannot be made to pass the obstruction, but flows back into the bladder without delineating the growth. Crance and Knickerbocker[31] were the first to clearly demonstrate a tumor of the ureter by this method. Later Scheele,[33] Stewart[34] and others showed the lesion by using fluid medium. Neuwirth and Bedrna[35] showed the possibility of demonstrating ureteral tumors by pneumo-ureterography. Although a case may present hæmaturia and an enlarged kidney, and bleeding may be induced by the passage of a ureteral catheter and the Röntgen plate may fail to show the presence of a stone, yet the diagnosis of a ureteral tumor must remain problematic. It is only when the ureterogram demonstrates a filling defect that the diagnosis can be made with certainty. This procedure is of course not indicated in cases where a tumor is actually seen presenting at the ureteral orifice. Owing to the difficulty of establishing a correct diagnosis, several cases have been operated upon for hydronephrosis in which, following the extirpation of the kidney, a second operation had to be performed to remove the tumor-bearing ureter (Van Capellen,[36] Judd and Struthers,[5] Sutter Toupet and Gueniot, and others). Even at operation it may be impossible to feel a soft papillomatous type of tumor in the ureter. In 29.4 per cent.

of the cases within this series, the diagnosis was established by the presence of a tumor protruding from the ureteral meatus.

Metastases.—Metastasis and invasion of neighboring structures are characteristic of malignant tumors of the ureter. A survey of Table V indicates that the retroperitoneal nodes (48.1 per cent.), liver (22.2 per cent.), kidney (18.5 per cent.) and lungs (18.5 per cent.) constitute the most frequent sites for metastatic deposits. Invasion by the tumor into the neighboring muscles such as the psoas occurred in 11.1 per cent. of the cases that came to autopsy.

Treatment.—Although a review of the literature indicates a variety of treatments for this disease, the procedure of choice is complete nephro-ureterectomy by the extraperitoneal route. The transperitoneal method was used by Quimbly[37] and by Paschkis and Pleschner.[58] The extirpation of a single tumor situated in the lower ureter was carried out by Finsterer through the suprapubic route, and also by J. Thomson Walker,[38] who resected the lower portion of the ureter harboring the growth, and reimplanted its proximal end back into the bladder. The procedure which the author employed in two of his cases was a complete nephro-ureterectomy through a long Albarran incision extended downwards toward Poupart's ligament, the resection including a portion of the bladder wall adjacent to the ureteral meatus. The defect in the bladder was closed in layers and an indwelling DePezzar catheter introduced into the bladder through the urethra and left in place for one week to ten days for the purpose of preventing urinary leakage through the vesical suture line. In the third case a complete nephro-ureterectomy was performed without including the ureteral meatus. The tumor which presented at the orifice was treated by fulguration and radium through a subsequent suprapubic systotomy after operation. It is advisable to follow the surgical procedure with a full course of deep Röntgen therapy, especially directed to the liver, lungs and spine.

Tumors Arising from Structures Other than Mucous Membrane.—The tumors belonging to this group are of rare occurrence. They may arise from the musculature or connective-tissue constituents of the ureteral wall, are more frequently encountered in the young, and are rapidly growing malignant tumors. Unlike the epithelial type of tumor, they are rarely accompanied by hæmaturia. Watjen[39] reported a case of fibromyoma with hyalinization of the connective tissue and calcification which caused a stenosis of the lumen of the ureter, and suggested its origin from the smooth muscle of the wall of the ureter. Similar cases were reported by Brongersma[40] and by Djeng-Jan-Ku (quoted by Weinstock).[41] A case of round-cell sarcoma of the ureter was reported by Target (quoted by Heller).[42] Albarran quotes Witlutzky[43] as having found an alveolar sarcoma of the ureter and VorPahl attributes a similar case to Lichtheim.[44] Ribbert[45] reported a case of myosarcoma, and Binder[46] accidentally found at autopsy a tumor in the lower left ureter in a sixty-eight-year-old woman consisting of epithelium, muscle and connective tissue which had caused a stenosis of the lumen of the ureter. Caulk[47] re-

ported a hæmangioma of the juxtavesical portion of the ureter which could be felt through the vagina and which gave rise to hæmaturia.

PERSONAL CASE REPORTS

CASE I.—Mrs. C. W., aged forty-two years, first seen October 24, 1929, complaining of frequency of urination, dysuria and hæmaturia of three years' duration. On several occasions she experienced a dull ache in the left lumbar region. Although her appetite

FIG. 1.—(Case I.) Pyeloureterogram showing defect in ureterogram and pyonephrosis.

was poor, there was no apparent loss of weight. Past and personal history was essentially negative.

Cystoscopy.—Cystoscopy revealed a bladder diffusely inflamed. Situated about one centimetre above the right ureteral orifice there was a circular necrotic area measuring about two centimetres in diameter, the lower part of which was covered with blood-clot while the upper part was of a pale yellowish color and distinctly villous in character. A pedicle could not be seen, nor was there any evidence of irritation around the base of the lesion. The right ureter was easily catheterized, while the catheter encountered an

impassable obstruction in the left ureter three centimetres from the bladder. The 'pthalein concentration was good from the right kidney, and the urine obtained from that side showed a few red blood-cells. No specimen was obtained from the left kidney. Cultures

FIG. 2.—(Case I.) Showing condition of kidney and ureter found at operation.

from the right kidney were sterile and *B. coli communis* was recovered from the bladder. Specimens were negative for the bacillus of tuberculosis. Four days later a catheter was passed beyond the obstruction and reached to a point fifteen centimetres from the bladder

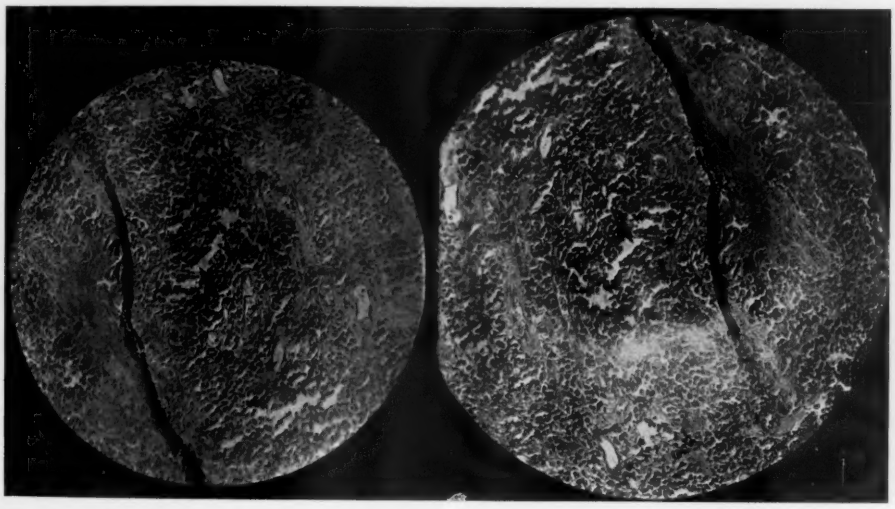

FIG. 3.—(Case I.) Low-power microphotograph of ureteral tumor.

FIG. 4.—(Case I.) High-power microphotograph of ureteral tumor.

where a second obstruction was encountered. A small quantity of thick turbid urine was obtained and showed pus microscopically. There was no return of the dye from

the left kidney. On culture, the specimen showed *B. coli communis* and *Streptococcus hæmolyticus*, but no evidence of tubercle bacilli.

A left pyelo-ureterogram revealed an enormous pyonephrosis with a marked dilatation of the upper ureter. In the region of the pelvis, and extending between the second and third transverse processes, there was a triangular negative shadow. (Fig. 1.) A second negative shadow was seen in the ureterogram between the transverse process of the fifth lumbar vertebra and the base of the sacrum.

FIG. 5.—(Case II.) Left pyelogram showing pyonephrotic kidney. Only upper portion of the ureter is outlined.

Tentative Diagnosis.—Left pyonephrosis, left pyo-ureter, left renal calculus and tumor of the left ureter.

Operation.—October 31, 1929. Under spinal anæsthesia (tropo-cocaine) supplemented with gas-oxygen narcosis, a complete left nephro-ureterectomy was performed. The kidney was completely pyonephrotic and contained a large calculus in its pelvis. Two ureters passed from the kidney to the bladder, one of normal size, and the other the size of a loop of small intestine. There was a high-grade periureteritis. In the juxtavesical

portion of the dilated ureter there was an indurated mass about the size of a cherry which was definitely infiltrating into the surrounding structures.

The kidney was mobilized through a seven-inch Albarran incision in typical manner and the ureters freed as far down as possible, and tied off with tape. The wound was then closed, the patient turned over on her back, and the ureters exposed extraperitoneally through a second incision and traced down to the bladder where they were divided between chromic ligatures. This wound was drained and closed in layers. The patient was then again placed in kidney position, the original wound reopened and the kidney with its ureters removed, after which the wound was closed in layers over appropriate drainage.

Pathological Report.—Specimen consists of a kidney and two ureters, one ureter enlarged and thickened and the other of normal dimensions. Several large cavitations are seen within the kidney, each containing a calculus. Practically all of the renal parenchyma between the cavities is replaced by fatty and fibrous tissue. The renal cortex is about 0.2

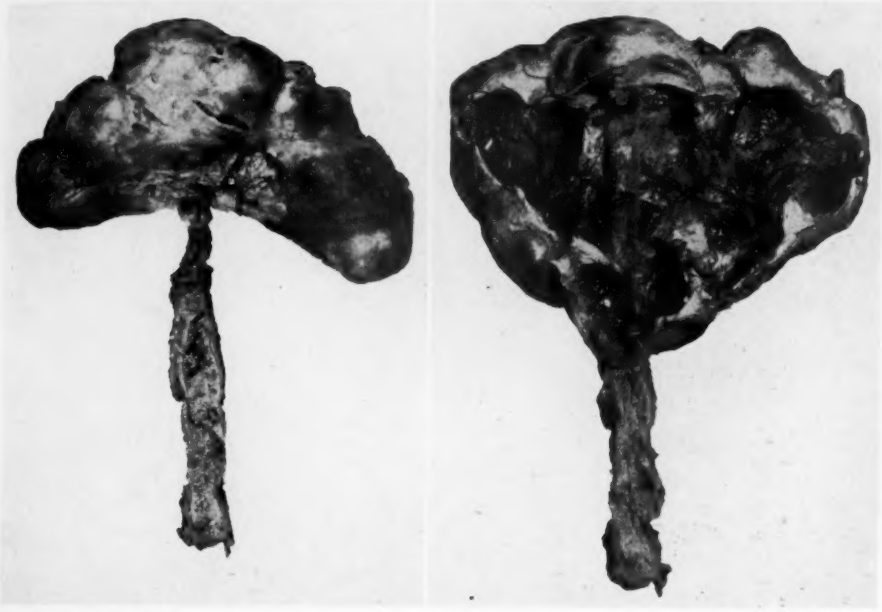

FIG. 6. FIG. 7.

FIG. 6.—(Case II.) Showing condition of kidney and ureter after fixation in formalin. Note necrotic condition of ureteral wall and tumor at lower end.
FIG. 7.—(Case II.) Note complete destruction of renal parenchyma.

centimetre in thickness. At the lower end of the dilated ureter there is a hard mass about the size of a cherry occluding the ureter lumen. (Fig. 2.)

Microscopical Diagnosis.—Calculus-pyonephrosis of kidney, pyo-ureter, medullary carcinoma of ureter. (Figs. 3 and 4.)

Subsequent Course.—November 30, 1929, the bladder was opened through the suprapubic route and five platinum-covered radon seeds aggregating 1,506 millicurie hours were implanted around the tumor over the left ureter orifice. The patient was discharged from the hospital December 19, 1929, in good condition. Cystoscopy performed two weeks later showed a slough at site of tumor.

Four months later cystoscopy revealed a tumor behind the right ureter orifice which was treated with radon seeds implanted through the cystoscope. The patient was recystoscoped five months later and no evidence of tumor found in the bladder. Deep Röntgen

therapy was given to the bladder, spine, lungs and liver. When last seen in October, 1930, the patient had developed metastases to the spine.

CASE II.—C. L., male, aged sixty-eight years, first seen May 15, 1930, complaining of hæmaturia of eight years' duration. Save for a gonorrhœa forty years ago, and a chancre thirty-eight years ago, the past history was essentially negative. The outstanding features of the physical examination were diffuse enlargement of the superficial lymph-nodes, dullness and increased breath sounds over both apices, feeble heart sounds and an enlarged, firm prostate.

Cystoscopy.—May 15, 1930. The bladder was thickened and trabeculated. There was a moderate hypertrophy of both lateral lobes and a well-defined hypertrophy of the median lobe of the prostate. Blood-clots were adherent to the left ureteral meatus. Both kidneys were easily catheterized. Urine from the right kidney was clear and negative

FIG. 8.—(Case II.) Microphotograph of tumor.

microscopically, while the urine from the left side contained blood. 'Pthalein concentration: right, good; left, poor. Specimens from both kidneys were sterile on culture and negative for the bacillus of tuberculosis, while the bladder urine showed a growth of *Staphylococcus albus.* Right pyelogram was negative. Left pyelogram revealed a large pyonephrosis and pyo-ureter with an acute "S" kink in its upper portion. A shadow suggestive of a stone could not be seen in the region of the kidneys or ureters. The left renal silhouette was, however, larger than that of the right kidney. (Fig. 5.)

The patient was again seen June 3, 1931, stating that he had had profuse hæmaturia for several days. Cystoscopy revealed several blood-clots in the bladder, one being firmly adherent to the left ureteral orifice. The lateral and median lobes of the prostate were greatly enlarged. An attempt to catheterize the left ureter was unsuccessful due to the presence of an impassable obstruction at one centimetre from the bladder. Uroselectan examination failed to show any dye in the left renal pelvis on a series of films taken over a period of two and a half hours. Operation was advised and refused.

The patient was again seen May 16, 1932, complaining of profuse hæmaturia, fever and marked asthenia. Cystoscopy now showed a lenticular tumor about the size of a small pea attached to the upper lip of the left ureteral meatus. A catheter could not be made to pass into the left ureter. The left kidney was felt to be definitely enlarged. Uroselectan revealed a very large left kidney which did not concentrate at any time during the examination; its ureter was never outlined. The right pelvis and ureter

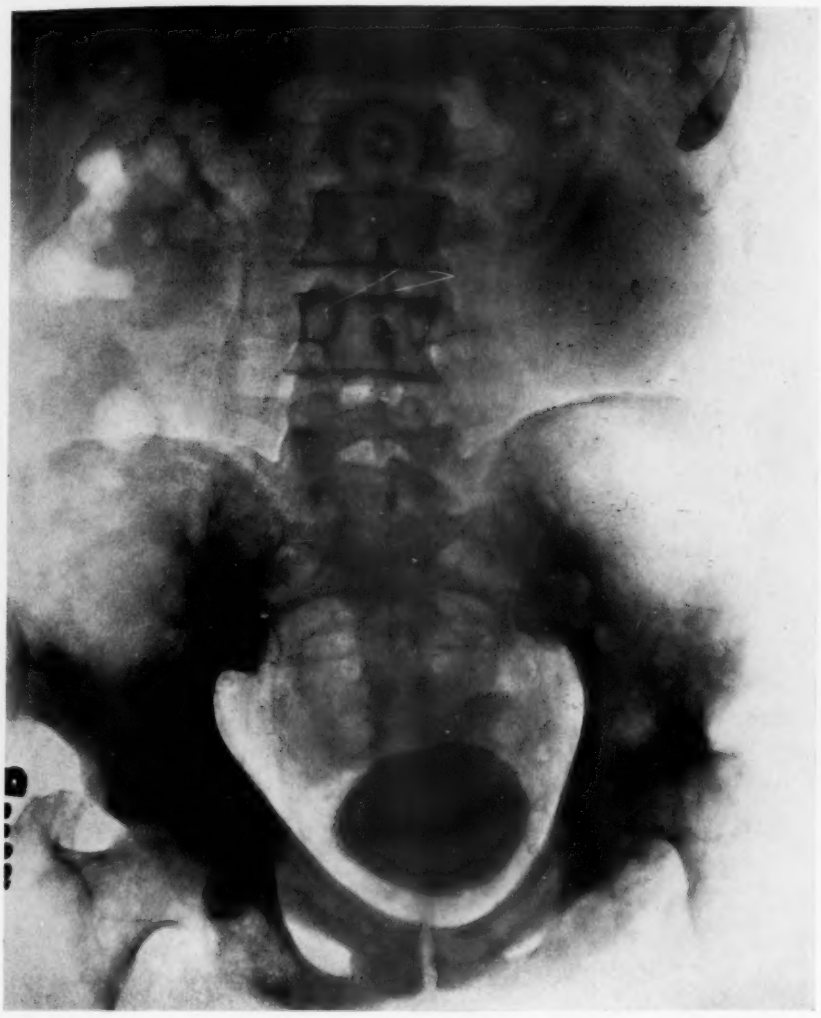

FIG. 9.—(Case III.) Intravenous pyelogram. Note enormous enlargement of left kidney with complete absence of dye in plevis or ureter.

were normal. A chest plate showed old healed tuberculous lesions in both lungs. There was no evidence of metastases. A diagnosis was now made of tumor of the left ureter, left pyonephrosis and pyo-ureter.

Operation.—May 20, 1932. Under spinal anæsthesia (tropo-cocaine) a complete left nephro-ureterectomy was performed through a nine-inch Albarran incision. The kidney was enormously enlarged, reaching from the diaphragm to the crest of the ileum, completely pyonephrotic and intimately adherent to the surrounding structures. The ureter was markedly dilated and thickened and adherent to its bed. Situated in the extreme end

of the ureter there was a hard nodule about the size of a pea. The entire kidney, ureter and a portion of the bladder wall with the ureteral meatus were extirpated and the defect in the bladder closed with interrupted chronic sutures. The wound was drained and closed in layers. An indwelling catheter was passed into the bladder per urethram and strapped in place; the bladder being irrigated every six hours.

Convalescence was uneventful, the catheter was removed after ten days, and the patient was discharged from the hospital in good condition June 19, 1932, the twenty-ninth day after operation.

Pathological Report.—Specimen consists of a kidney measuring eighteen by nine by eight centimetres, completely pyonephrotic, showing no parenchyma. The ureter measures eighteen by one and one-half centimetres with a tumor situated in its distal portion. The lumen of the ureter was filled with necrotic material. (Figs. 6 and 7.)

FIG. 10.—(Case III.) Showing condition of kidney and dilated ureter. Note tumor at end of ureter.

FIG. 11.—(Case III.) Ureter opened. Note two growths in lumen of ureter.

Microscopical Diagnosis.—Diffuse pyonephrosis, pyo-ureter and papillary carcinoma of the ureter. (Fig. 8.)

CASE III.—M. B., a male, aged sixty-six years, first seen in consultation August 27, 1931, complaining of difficulty of urination and hæmaturia, at which time a two-stage prostatectomy was performed for a fibrosis of the prostate and contracture of the vesical neck. The patient was again seen six months later complaining of hæmaturia, loss of weight (ten pounds) and pains in both hips.

Cystoscopy.—Cystoscopy revealed a moderately thickened and trabeculated bladder with well-defined Mercier's and median bars. The left ureteral orifice bulged into the vesical lumen and was surrounded by a small papillomatous tumor. The left catheter encountered an impassable obstruction at two centimetres from the bladder. The right ureter could not be visualized.

Intravenous Pyelography.—The pyelograms revealed the right kidney of normal size, shape and position with a normally formed pelvis. The left kidney appeared enormously enlarged, with a pear-shaped bulging of its lower pole. Plates taken at intervals over a period of four hours failed to show the presence of the dye in the left renal pelvis. (Fig. 9.) Situated on the upper margin of the bladder silhouette, and to the left of the mid-line, there was a shadow, ovoid in shape, and the size of a small cherry.

The outstanding features of the physical examination were a rough systolic murmur heard at the apex with an hypertrophy of the heart to the left; blood-pressure 200/100; the liver edge was palpable two fingers' breadth below the costal arch and the left kidney felt greatly enlarged. There was a moderate ankylosis of the left hip. Röntgenological study of the chest failed to show the presence of pulmonary metastases. The pre-operative

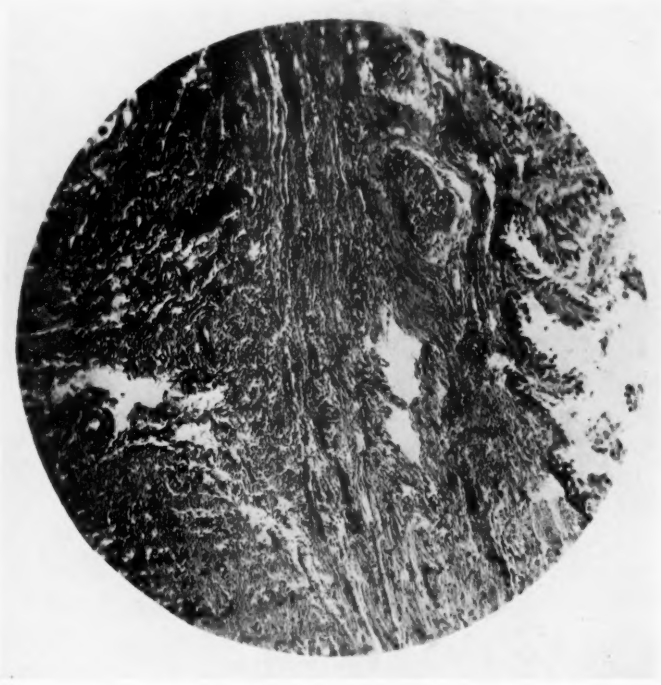

FIG. 12.—(Case III.) Microphotograph of tumor.

diagnosis was left hydronephrosis, left hydroureter and primary carcinoma of the left ureter.

Operation.—April 20, 1932. Under spinal anæsthesia (tropo-cocaine) the left kidney and ureter were exposed through a single nine-inch Albarran incision. The kidney was represented by an enormous sac involving mostly its pelvis and lower three-quarters of the renal parenchyma. The ureter was enlarged to the size of a loop of small intestine down to the bladder. At the juxta-vesical portion of the ureter one could feel a nodular mass about the size of a cherry. Situated at the ureteral orifice there was a papillomatous tumor, the size of a pea. (Fig. 10.) The kidney and ureter were densely adherent to the surrounding structures (perinephritis and periureteritis). The renal pedicle seemed to enter the kidney very close to its upper pole.

With great difficulty the kidney and entire ureter were mobilized together. In order to remove a portion of the bladder adjacent to the left ureteral meatus, it was necessary to divide the left vas deferens between two ligatures; the former procedure was then easily accomplished. The opening in the bladder was closed with interrupted chromic

sutures. A rubber dam and tube were introduced into the pelvis, and one tube was placed into the renal fossa and the wound closed in layers, following which an indwelling catheter was left in the bladder per urethram.

Specimen.—The specimen consisted of a large hydronephrotic kidney measuring thirteen by eight by seven centimetres, filled with necrotic and hæmorrhagic fluid. The ureter which was attached to the kidney measured seventeen centimetres and was over two and a half centimetres in diameter, and was filled with fluid similar to that found in the kidney. Blocking the ureteral meatus there was a villous growth about the size of a small pea. With the ureter opened, it was seen that there was a second growth about one and a half inches above the meatus which was flat, papillomatous, and occupying about one inch of the ureteral wall. Situated about three-quarters of an inch above the growth just described, there was a third tumor which felt nodular and was the size of a lima-bean. There was no growth within the kidney or its pelvis. (Fig. 11.)

Microscopical Diagnosis.—Left pyonephrosis, left pyo-ureter and multiple papillary adeno-carcinomata of the ureter. (Fig. 12.)

Subsequent Course.—The patient made an uneventful recovery, the wound healing by primary union with very little drainage through the tubes. The indwelling catheter was removed on the ninth day after operation and the patient discharged from the hospital on the twelfth post-operative day. Since leaving the hospital, he has been receiving a course of deep Röntgen therapy.

TABLE I

68 cases	Females	32	Right	32	68
			Left	33	
	Males	36	Unrecorded	3	

Age Incidence	Number of Cases	Percentage
First decade	0	
Second decade	0	
Third decade	0	
Fourth decade	4	5.8
Fifth decade	17	25.
Sixth decade	15	22.
Seventh decade	19	27.9
Eighth decade	8	11.7
Ninth decade	2	2.9
Not recorded	3	4.4

TABLE II

Symptoms	Number of Cases	Percentage
Hæmaturia	51	75.
Loss of weight	12	17.5
Renal pain	31	45.5
Pain in abdomen	4	5.8
History or evidence of calculus	10	14.7
Backache	6	8.7

TABLE III

Positive Diagnostic Signs	Number of Cases	Percentage
Enlarged kidney	25	35.2
Mass felt along course of ureter	7	10.2
Obstruction of ureter elicited with catheter	26	38.2
Blood through ureter catheter	12	17.5
Tumor presenting at ureter orifice	20	29.4
Filling defect in ureterogram	6	8.7

TABLE IV

Duration of Symptoms	Number of Cases	Percentage
One month or less	5	9.8
One to six months	15	29.4
Six to 12 months	8	15.6
One to two years	11	21.5
Over two years	12	23.5
Unknown or unrecorded	17	

In this table fifty-one patients are used as basis of estimation, since in seventeen the duration of symptoms is unrecorded.

TABLE V

Pathological Reports

	Number of Cases	Percentage
Associated hydronephrosis	46	67.6
Associated hydro-ureter	35	51.4
Reports of Microscopical examination of ureteral tumors:		
1. Transitional cell	2	2.9
2. Adeno-carcinoma	2	2.9
3. Carcinoma solidum	3	4.4
4. Medullary carcinoma	6	8.7
5. Carcinoma	6	8.7
6. Cylindrical-cell epithelioma	1	1.5
7. Encephaloid carcinoma	1	1.5
8. Scirrhous carcinoma	1	1.5
9. Papillary carcinoma	28	41.1
10. Squamous carcinoma	8	11.7
11. Epithelioma	9	13.2
12. Not recorded	4	5.8
Metastases and direct invasions (twenty-seven post-mortems)		
1. Retroperitoneal nodes	13	48.1
2. Intestine	1	3.7
3. Peritoneum	1	3.7
4. Pancreas	1	3.7
5. Rectum	2	7.4
6. Pericardium	1	3.7
7. Bladder	5	18.5
8. Spleen	1	3.7
9. Liver	6	22.2
10. Kidney	5	18.5
11. Muscle	3	11.1
12. Lung	5	18.5
13. Nerves	1	3.7
14. Bone	2	7.4
15. Vasa deferentia	1	3.7
16. Vagina	1	3.7
17. Prostate	1	3.7

TABLE VI

	Number of Cases	Percentage
Cases diagnosed as tumors of ureter	22	32.3
Cases diagnosed as probable tumors of ureter	4	5.8
Cases diagnosed as tumor of genito-urinary tract other than ureteral	13	19.1
Miscellaneous diagnoses	14	22.
Cases in which no diagnoses were made	15	22.6

Summary and Conclusions.—Primary malignant tumors of the ureter are exceedingly rare, as indicated by the fact that, after a careful search of the literature, only sixty-eight cases could be collected, including three reported by the writer in this communication. Of the total number of tumors, 42 per cent. were of the non-papillary type. Malignant tumors of the ureter are most frequently found in the lower part of the ureter and are usually associated with hydronephrosis (67 per cent.), and hydro-ureter (51 per cent.).

The disease is most prevalent in the sixth and seventh decades (50 per cent.). The growth is invasive and metastasizes readily to the regional lymph-nodes (48 per cent.), lungs (18 per cent.) and liver (22 per cent.).

Although pain, hæmaturia and enlargement of the kidney constitute the characteristic triad of symptoms of this disease, it was found that hæmaturia alone was the outstanding symptom (75 per cent.). The diagnosis of this disease can be made, however, only by carefully executed and interpreted cystoscopical X-ray procedures. The presence of a tumor at the ureteral orifice is a highly suggestive finding, yet it was reported in only 29 per cent. of the cases in this series. A definitely established filling-defect in the ureterogram is the only pathognomonic sign of a tumor of the ureter, and was reported in only 8.7 per cent. of the cases. The infrequency of this finding is probably due to failure to suspect the lesion and consequently to the failure of carrying out carefully made ureterograms. If, upon encountering an obstruction in the ureter (38.2 per cent.), provocating bleeding by manipulation of the catheter, and failing to demonstrate a shadow suggestive of calculus at the site of obstruction on the Röntgen film, one were to suspect the possibility of this condition, it seems to the author that repeated attempts at ureterograms would eventually demonstrate a filling defect in a greater percentage of cases, thus clinching the diagnosis of ureteral neoplasm. Failure to diagnose such a lesion has on several occasions led the operator to perform a simple nephrectomy for hydronephrosis and to learn later to his great chagrin that the hæmaturia had recurred, thereby necessitating a second operation for the purpose of removing the tumor-bearing ureter. Owing to the difficulty encountered at times of palpating the tumor within the ureter at the time of the operation, it seems better in those cases where operation is undertaken for the purpose of exploring the upper urological tract for hæmaturia especially when tumor of the ureter is not suspected, to carry out a complete ureterectomy with the nephrectomy in the event the kidney itself fails to fully account for the bleeding.

The procedure of choice in the treatment of this disease is complete nephro-ureterectomy carried out by the extraperitoneal approach, the resection including a portion of the bladder adjacent to the ureteral meatus. The operation is best carried out under spinal anæsthesia and concluded by placing an indwelling catheter into the bladder through the urethra and retained for a week or ten days.

It is the hope of the writer that this analysis of reported cases of primary malignant tumors of the ureter may lead to a better understanding of this disease, so that future cases may be recognized earlier and the patients subjected to radical surgical procedures so essential to the attainment of successful results.

ABSTRACT OF REPORTED CASES

P. Rayer (1841).—Female, aged fifty-eight years. Clinical Findings.—Pain in abdomen; hæmaturia. Result.—Autopsy. Pathological Findings.—Pedunculated tumors right ureter, calyces and bladder. Microscopical.—Not given.

Wising and Blix (1878).—Female, aged forty-one years. Clinical Findings.—Pain right flank and abdomen; enlarged right kidney. Result.—Autopsy. Pathological Findings.—Tumor upper right ureter; invading the renal pelvis with hydronephrosis; metastases to peritoneum, retroperitoneal nodes and rectum. Microscopical.—Medullary carcinoma.

R. Davy (1884).—Male, aged fifty-three years. Clinical Findings.—Pain left loin; penis; intermittent hæmaturia; enlarged left kidney. Associated Calculi.—Previous history of calculus left ureter. Pre-operative Diagnosis.—Cyst of left kidney and ureter. Treatment.—Nephrotomy and nephrectomy. Result.—Death two months after operation. Pathological Findings.—Kidney hydronephrosis; autopsy; hydro-ureter; tumor lower ureter with calculus; tumor invasion of bladder and perforation into rectum; metastases to liver and lymph-nodes. Microscopical.—Encephaloid carcinoma of left ureter.

G. Jona (1894).—Male. Clinical Findings.—History not given save of patient having a lobar pneumonia. Pre-operative Diagnosis.—Condition not suspected. Diagnosis.—Lobar pneumonia. Result.—Death. Pathological Findings.—Post-mortem. Tumor left ureter probably occurring in diverticulum of ureter. Microscopical.—Epithelioma of ureter.

F. Voelscher[48] (1895).—Male, sixty-eight years old. Clinical Findings.—Backache; hæmaturia loss of weight. Pre-operative Diagnosis.—Malignancy, location not stated. Treatment.—Tapping of a fluctuant tumor, probably kidney; no operation. Result.—Death. Pathological Findings.—Autopsy. Tumor situated in lower two inches of left ureter; metastases to liver, lungs, lymph-nodes; right hydro-ureter and nephrosis. Microscopical.—Villous carcinoma of left ureter.

H. Rundle,[49] Tr. Path. Soc., London, vol. lvii, p. 128 (1896).—Male, aged forty-six years. Clinical Findings.—Enlarging tumor right flank; hæmaturia; loss of weight. Pre-operative Diagnosis.—Malignancy suspected, location not stated. Treatment.—Tapping of a fluctuant tumor, probably kidney; no operation. Result.—Death. Pathological Findings.—Post-mortem. Tumor lower three inches right ureter invading bladder wall and vasa deferentia with hydronephrosis and ureter. Microscopical.—Squamous-cell carcinoma of right ureter.

L. Hektoen[50] (1896).—Female, aged fifty years. Clinical Findings.—Pain right loin radiating to hip; a tumor mass apparently attached to right ilium felt in right lower quadrant. Pre-operative Diagnosis.—Osteosarcoma. Result.—Death. Pathological Findings.—Post-mortem. Microscopical.—Medullary carcinoma of right ureter.

Toupet and Gueniot, Bull. Soc. Anat. de Paris, vol. xii, p. 677 (1898).—Female, aged eighty-nine years. Clinical Findings.—Pain in abdomen; loss of appetite; no hæmaturia; large tumor left side of abdomen. Pre-operative Diagnosis.—Hydatid cyst; hydronephrosis. Result.—Death. Pathological Findings.—Post-mortem. Obstructing tumor left upper ureter (uretero-pelvic juncture), left hydronephrosis. Microscopical.—Carcinoma of left ureter.

Toupet and Gueniot, Bull. Soc. Anat. de Paris, vol. xii, p. 677 (1898).—Female, aged sixty-four years. Clinical Findings.—Pain in right loin; hæmaturia; palpable mass right abdomen. Cystoscopy.—Obstruction right ureter at five centimetres. Treatment.—Nephrectomy, followed at a later date by ureterectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. Right hydronephrosis; hydro-ureter and tumor right ureter. Microscopical.—Solid carcinoma of the right ureter.

B. Poll,[52] Beitr. z. Klin. Chir., vol. xxiii, p. 822 (1899).—Male, aged forty-one years. Clinical Findings.—Pain left kidney; hæmaturia; history of injury to left hip and thigh; large left kidney. Cystoscopy.—Tumor present at left ureter orifice. Pre-operative Diagnosis.—Left renal tumor. Treatment.—Nephro-ureterectomy. Result.—Death thirty-one days post-operative. Pathological Findings.—Surgical specimen. Left kidney, pelvis and ureter dilated and containing multiple papillary growths extending into the bladder. Microscopical.—Not given.

K. Minich[51] (1902).—Female, aged sixty-six years. No history. Pre-operative Diagnosis.—Not noted. Pathological Findings.—Post-mortem. Tumor lower third of right ureter invading bladder and perforating vagina. Microscopical.—Carcinoma of right ureter.

K. Gerstein (1902).—Male, aged sixty-seven years. Clinical Findings.—Hæmaturia; urgency; pain right lumbar region; anæmia. Cystoscopy.—Tumor right ureter orifice. Pre-operative Diagnosis.—Malignant growth of right ureter orifice. Treatment.—Suprapubic cystotomy and fulguration of tumor. Result.—Died fifteen days post-operative. Pathological Findings.—Post-mortem. Large tumor at right ureter orifice; two nodules right vesical wall; metastases to right kidney and lung; extension of tumor into prostate; right hydronephrosis. Microscopical.—Carcinoma right ureter.

St. Thomas Hosp. Report,[53] vol. xxxii, p. 96 (1904).—Male, aged sixty-nine years. Clinical Findings.—Backache; hæmaturia; lump to the left of umbilicus. Pre-operative Diagnosis.—Not stated. Treatment.—Not stated. Result.—Death. Pathological Findings.—Post-mortem. Left hydronephrosis and hydro-ureter with tumor of left ureter; metastases to retroperitoneal glands. Microscopical.—Cells of transitional epithelium.

K. Vor Pahl (1905).—Female, aged sixty years. Clinical Findings.—Intermittent right abdominal colic with large right kidney; urine showed red blood-cells. Cystoscopy.—Mass protruding from and obstructing right ureter orifice. Pre-operative Diagnosis.—Stricture or tumor of right ureter with calculus and hydronephrosis. Treatment.—Nephro-ureterectomy. Result.—Death eight hours post-operative (embolus). Pathological Findings.—Post-mortem. Right hydronephrosis and hydro-ureter with tumor of ureter; metastases to lungs, liver, retroperitoneal lymph-nodes. Microscopical.—Medullary carcinoma of right ureter orifice and scirrhous carcinoma of middle right ureter.

W. F. Metcalf and H. E. Safford, Am. Jour. Sci., vol. cxxix, p. 50 (1905).—Male, aged forty-seven years. Clinical Findings.—Attacks of right colic for years with history of stone passage on two occasions. Physical Examination.—Spasm left loin, otherwise negative. Cystoscopy.—Field obscured by bleeding. Associated Calculi.—Calculus. Pre-operative Diagnosis.—Left ureteral calculus. Treatment.—Nephro-ureterectomy. Pathological Findings.—Surgical specimen. Left pyonephrosis and pyo-ureter with tumor and stone in lower left ureter. Microscopical.—Adeno-carcinoma of left ureter.

L. Adler (1905).—Male, aged sixty-nine years. Clinical Findings.—Intermittent pain over sacrum, radiating to bladder; tenderness left kidney; no hæmaturia. Pre-operative Diagnosis.—Tuberculosis; tumor of left adrenal (?); Addison's disease. Result.—Died. Pathological Findings.—Post-mortem. Left hydronephrosis and hydro-ureter with tumor in lower left ureter; metastases to body of lumbar vertebra. Microscopical.—Papillary and squamous-cell carcinoma left ureter.

Zironi[54] (1909).—Female, aged thirty-six years. Clinical Findings.—Pain in back radiating to bladder; hæmaturia; enlarged right kidney. Pre-operative Diagnosis.—Right renal tumor. Treatment.—Nephrotomy. Result.—Died. Pathological Findings.—Post-mortem. Right hydronephrosis and hydro-ureter with tumor of middle third of right ureter; metastases to retroperitoneal glands. Microscopical.—Squamous-cell epithelioma of right ureter.

J. Richter[52] (1909).—Female, aged eighty years. Clinical Findings.—Pain in sacrum and buttock radiating to right leg; hæmaturia. Physical Examination.—Negative. Pre-operative Diagnosis.—Neoplasm of urinary tract. Result.—Died. Pathological Findings.—Post-mortem. Tumor, size of hazel nut, situated three centimetres above right ureter orifice; hydro-ureter and hydronephrosis; metastases to regional nodes. Microscopical.—Papillary carcinoma right ureter.

R. Paschkis, Wien. Klin. Wchnschr., vol. xxiii, p. 361 (1910).—Male, aged sixty-five years. Clinical Findings.—Recurrent left renal colic many years; severe attack four months ago with hæmaturia (hospital). Associated Calculi.—Calculus. Pre-operative Diagnosis.—Malignant growth left renal pelvis with hydronephrosis. Result.—Died. Pathological Findings.—Post-mortem. Invasive tumor size of a lemon in lower third

of left ureter; metastases to left kidney and retroperitoneal nodes; hydronephrosis and hydro-ureter. Microscopical.—Papillary carcinoma left ureter.

J. Israel (1910).—Female, aged sixty years. Clinical Findings.—Pain left hypochondrium radiating to left breast, arm and thigh of ten years' duration; jaundice; hæmaturia; mass in abdomen (left) for ten years. Pre-operative Diagnosis.—Tumor left kidney with hydronephrosis. Treatment.—Splenectomy nephrectomy. Result.—Died after operation. Pathological Findings.—Post-mortem. Tumor left ureter; metastases to left kidney; splenomegaly. Microscopical.—Papillary carcinoma left ureter.

M. Chevassu and J. Mock, Bull. et Mem. Soc. de Chir. de Par., vol. xxxviii, p. 522 (1912).—Male, aged fifty-three years. Clinical Findings.—Pain in suprapubic region; scrotum; perineum one year; hæmaturia five weeks; double varicocoele. Cystoscopy.—Left catheter meets obstruction at fifteen centimetres with blood; poor function left kidney. Pre-operative Diagnosis.—Tumor left ureter. Treatment.—Nephro-ureterectomy. Pathological Findings.—Surgical specimen. Left hydronephrosis and hydro-ureter; situated in the upper ureter there is a tumor about the size of an olive with a small nodule three centimetres below the first one. Microscopical.—Epithelioma left ureter.

V. Chiari (1914).—Female, aged fifty-four years. Clinical Findings.—Hæmaturia; loss of weight. Physical Examination.—Negative. Cystoscopy.—Left catheter meets impassable obstruction eight centimetres with return of blood; no function. Pre-operative Diagnosis.—Tumor of left kidney, left renal pelvis or left ureter. Treatment.—Nephro-ureterectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. A tumor situated in the middle of the left ureter extending into surrounding tissues, about the size of a cherry, with dilatation of the ureter. Microscopical.—Papillary carcinoma of left ureter.

F. A. Butler, Clifton Med. Bull., vol. ii, p. 48 (1914).—Male, aged fifty-three years. Clinical Findings.—Hæmaturia seventeen months; pain in right sacro-iliac region; loss of weight; situated to the right of the umbilicus a small fixed tumor was situated, attached to the posterior abdominal wall with enlarged right testicle. Cystoscopy.—Obstruction right ureter six centimetres from bladder. Pre-operative Diagnosis.—Sarcoma right ileum. Treatment.—Biopsy of tumor. Result.—Died. Pathological Findings.—Post-mortem. Tumor situated in centre of ureter invaded the psoas and iliacus muscles, posterior peritoneum and lumbar plexus. Microscopical.—Squamous-cell carcinoma of right ureter.

P. Spiess,[55] Centralbl. f. allg. Path. u. path. Anat., vol. xxvi, p. 553 (1915).—Female, aged forty-one years. Clinical Findings.—Pain in loins, hips and hypogastrium. Pre-operative Diagnosis.—Sciatica; dementia præcox. Result.—Died. Pathological Findings.—Post-mortem. Right hydro-ureter and hydronephrosis; tumor in lower right ureter with metastases in regional and mesenteric nodes and psoas muscle. Microscopical.—Carcinoma solidum simplex.

H. Finsterer (1915).—Male, aged thirty-five years. Clinical Findings.—Hæmaturia four years. Pre-operative Diagnosis.—Papilloma of bladder. Treatment.—Partial ureterectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. Right hydronephrosis and hydro-ureter with papillomatous tumor of lef ureter. Microscopical.—Beginning malignant degeneration of papilloma of ureter.

A. Nilssen, Kristiania Kirurg. for. forh., vol. xiii (1915).—Female, aged sixty-eight years. Clinical Findings.—Hæmaturia two years; mass in right upper quadrant (kidney). Cystoscopy.—Right ureter obstructed at fifteen centimetres; no bleeding; hydronephrosis tapped two years later; papillomatous tumor seen right ureter orifice. Pre-operative Diagnosis.—Malignancy of right ureter. Treatment.—Nephro-ureterectomy. Result.—Died one month after operation. Pathological Findings.—Right hydro-ureter with hæmatonephrosis; tumor right lower ureter. Microscopical.—Papillary carcinoma of right ureter with metastases to retroperitoneal nodes.

K. R. Hofmann (1916).—Male, aged thirty-five years. Clinical Findings.—Hæmaturia four years; loss of weight. Cystoscopy.—Papillary tumor covering ureteral orifice.

Treatment.—Suprapubic cystotomy with resection of ten centimetres of ureter and implantation of upper end into bladder. Pathological Findings.—Surgical specimen. Tumor of ureter the size of a pigeon's egg. Microscopical.—Papilloma with beginning malignant changes.

Van Capellen (1916).—Female, aged forty-six years. Clinical Findings.—Pain right side; fever; frequency; hæmaturia; enlargement of right kidney with tenderness. Cystoscopy.—Redness of right ureter orifice; slow flow of cloudy urine from right kidney; no obstruction. Pre-operative Diagnosis.—Pyonephrosis. Treatment.—Nephrectomy and five months later ureterectomy. Pathological Findings.—Surgical specimen. Right pyo-ureter and nephrosis with tumor in mid-portion of right ureter. Microscopical.—Papillary carcinoma of right ureter.

E. S. Schmitt,[66] Jour. Cancer Research, vol. i, p. 461 (1916).—Female, aged fifty-five years. Clinical Findings.—Abdominal pain (diffuse) and in left inguinal region; vomiting and anæmia; no hæmaturia. Pre-operative Diagnosis.—Intestinal obstruction; tuberculosis peritonitis. Treatment.—No operation recorded. Result.—Died twelve days after entering hospital. Pathological Findings.—Post-mortem. Tumor situated in upper left ureter invading kidney, pelvis, psoas and vertebræ, with metastases to liver, left kidney and vertebræ; left pyonephrosis. Microscopical.—Transitional-cell carcinoma left ureter.

Knack,[67] Deutsch. med. Wchenschr., vol. xliv, p. 982 (1918).—Male, aged seventy-three years. Clinical Findings.—No history given. Pre-operative Diagnosis.—No record; cardiac and renal insufficiency. Result.—Died. Pathological Findings.—Post-mortem. Left hydronephrosis; right malignant sclerosis; mid-ureter tumor. Microscopical.—Papillary carcinoma left ureter.

Paschkis and Pleschner (1920).—Female, aged fifty-five years. Clinical Findings.—Pain in right kidney; hæmaturia; frequency; enlarged right kidney; a second small tumor felt below kidney. Cystoscopy.—Papillary tumor in region of right ureter orifice. Pre-operative Diagnosis.—Right renal tumor. Treatment.—Nephro-ureterectomy. Pathological Findings.—Surgical specimen. Tumor of right ureter one centimetre above bladder; hydronephrosis and hydro-ureter. Microscopical.—Papillary carcinoma right ureter.

Judd and Struthers (1921).—Male, aged forty-eight years. Clinical Findings.—Hæmaturia two years; pain in penis on micturition. Cystoscopy.—Blood left ureter; obstruction left ureter orifice by stone and tumor. X-ray.—Shadow lower left ureter. Associated Calculi.—Stone. Pre-operative Diagnosis.—Left ureter neoplasm; tumor left kidney; obstruction left meatus. Treatment.—Nephrectomy; eleven days later ureterectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. Left pyonephrosis and pyo-ureter; papillary tumor lower left ureter. Microscopical.—Papillary epithelioma left ureter.

F. Suter (1922).—Male, aged sixty-five years. Clinical Findings.—Pain in left kidney and hæmaturia. Cystoscopy.—Obstruction left ureter at eight centimetres from the bladder. Treatment.—Nephrectomy; secondary operation attempted; ureterectomy abandoned due to pressure of tumor against iliac vessels. Pathological Findings.—hydro-ureter; tumor mass over left iliac vessels.

P. W. Aschner (1922).—Male, aged thirty-eight years. Clinical Findings.—Pain in right flank radiating down groin; vomiting; chills and fever; patient thought he passed stone; hæmaturia. X-ray.—Right renal calculi. Cystoscopy.—No obstruction to catheter. Associated Calculi.—Calculus. Pre-operative Diagnosis.—Renal calculi. Treatment.—Nephrotomy; secondary operation nephro-ureterectomy. Pathological Findings.—Surgical specimen. Right hydronephrosis; tumor right ureter. Microscopical.—Squamous-cell carcinoma of ureter.

Meeker and McCarthy (1923).—Male, aged forty-nine years. Clinical Findings.—Pain in right hip radiating to groin; cord-like structure felt in course of right ureter. Cystoscopy.—Right ureter obstructed at level of sacrum. Pre-operative Diagnosis.—

Malignancy right ureter. Result—Died. Pathological Findings.—Post-mortem. Carcinoma right ureter; hydronephrosis; metastases to liver; lungs; pericardium; spleen; pancreas; left kidney and lymph-nodes. Microscopical.—Papillary epithelioma right ureter.

H. L. Kretschmer (1924).—Male, aged seventy-four years. Clinical Findings.—Hæmaturia; loss of weight. Physical Examination.—Negative. Cystoscopy.—Distorted left ureter; no obstruction. Pre-operative Diagnosis.—Left renal tumor; hydronephrosis. Treatment.—Nephro-ureterectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. Left hydronephrosis; tumor left ureter. Microscopical.—Papillary carcinoma of ureter.

Crance and Knickerbocker (1924).—Female, aged forty-two years. Clinical Findings.—Enlarged right kidney; hæmaturia; frequency; dysuria; pain in bladder. X-ray.—Negative. Cystoscopy.—Obstruction right ureter seven centimetres; no dye right kidney; ureteropyelogram; dilated ureter above obstruction; filling defect. Pre-operative Diagnosis.—Ureteral obstruction, probably tumor; hydro-ureter and hydronephrosis. Treatment.—Nephro-ureterectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. Right hydronephrosis and hydro-ureter; tumor right ureter. Microscopical.—Mucous-membrane epithelioma (carcinoma).

J. Z. Mraz[59] (1924).—Female, aged sixty-nine years. Clinical Findings.—Pain in right lumbar region; hæmaturia; loss of weight; mass in left flank; small tumor palpable in region of right lower ureter. Cystoscopy.—Obstruction right ureter four centimetres; blood seen alongside catheter. Pre-operative Diagnosis.—Malignancy of upper urinary tract with secondary implantation in lower ureter and hydronephrosis. Treatment.—Nephro-ureterectomy. Result.—Died eight months after operation. Pathological Findings.—Surgical specimen. Tumor right lower ureter; right hydronephrosis. Microscopical.—Carcinoma of ureter.

M. Papin,[60] J. d'Vrol, vol. xvii, p. 325 (1924).—Clinical Findings.—Pain in right abdomen radiating to groin and right testicle; no hæmaturia but dysuria; no masses; loss of weight. Cystoscopy.—Obstruction right ureter three-quarters way up; followed by bleeding. Pre-operative Diagnosis.—Probably neoplasm upper one-third right ureter. Treatment.—Resection of ureter containing tumor; kidney not removed. Pathological Findings.—Surgical specimen. Tumor upper right ureter. Microscopical.—Cylindrical-cell epithelioma.

Day, Fairchild and Martin,[61] Surg., Gynec. and Obst., vol. xl, p. 486 (1925).—Female, aged fifty-four years. Clinical Findings.—Hæmaturia; pain on right side; large right kidney. Cystoscopy.—Right ureter obstructed four centimetres. Treatment.—Nephrectomy and partial ureterectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. Right hydronephrosis; papillomatous tumor right ureter. Microscopical.—Papillary carcinoma right ureter.

H. V. Zobel,[62] Centrabl. f. allg. Pathol. u. path. Anat., vol. xxxvi, p. 142 (1925).—Male, aged seventy years. Clinical Findings.—Not given. Pathological Findings.—Post-mortem. Left perinephritic abscess with tumor, size of a walnut, in left ureter.

H. L. Posner,[63] Monatschr. f. Geburtsh. u. Gynaek., vol. lxxv. p. 86 (1926).—Female, aged sixty-six years. Clinical Findings.—Hæmaturia. Cystoscopy.—Tumor size of a cherry present at right ureter orifice. Pre-operative Diagnosis.—Stenosing carcinoma of right ureter with hydronephrosis. Treatment.—Cauterization of tumor; then nephrectomy and partial ureterectomy; later ureterectomy and resection of part of bladder. Result.—Recovery. Pathological Findings.—Surgical specimen. Tumor filling two-thirds of right ureter; right hydronephrosis and hydro-ureter. Microscopical.—Papillary carcinoma of right ureter.

R. L. Stewart, British Jour. Surg., vol. xiii, p. 667 (1926).—Female, aged seventy-five years. Clinical Findings.—Intermittent pain right side; hæmaturia. Cystoscopy.—Bullous œdema right ureter orifice; obstruction. Fifteen centimetres right ureter; bloody urine obtained. Pre-operative diagnosis.—Tumor right ureter. Treatment.—Nephrectomy

and partial ureterectomy. Pathological Findings.—Surgical specimen. Sessile papillary tumor right ureter; kidney and upper ureter normal. Microscopical.—Primary papillary epithelial tumor of right ureter.

J. Gottlieb, Ztschr. f. Urol. Chir., vol. xx, p. 230 (1926).—Female, aged forty-nine years. Clinical Findings.—Dysuria; pain in left loin and hæmaturia. X-ray.—Stones in left kidney; enlarged left kidney. Cystoscopy.—Left ureter orifice hyperæmic; no dye from left kidney. Associated Calculi.—Stone. Pre-operative Diagnosis.—Not reported. Treatment.—Nephrectomy and ureterectomy. Pathological Findings.—Surgical specimen. Left hydro-ureter above the site of the tumor with left hematonephrosis; tumor left ureter extending into retroperitoneal fat; two enlarged lymph-nodes. Microscopical.—Medullary carcinoma of left ureter.

R. Glas,[64] Wien. Klin. Wchnschr., vol. xxxix, p. 1145 (1926).—Female, aged seventy-one years. Clinical Findings.—Pain along sciatic nerve; no history of hæmaturia; bilateral renal enlargement. Cystoscopy.—Obstruction one centimetre left ureter; catheter passed half-way up right ureter; no dye. Result.—Died. Pathological Findings.—Post-mortem. Left hydro-nephrosis and hydro-ureter; right hydro-ureter; tumor in middle third of left ureter. Microscopical.—Carcinoma left ureter.

P. Blatt,[65] Wien. Klin. Wchnschr., vol. xxxix, p. 1130 (1926).—Male, aged fifty-five years. Clinical Findings.—Pain in both loins; hæmaturia; right nephrectomy fifteen months previously; hæmaturia recurred with pain in right lower quadrant radiating to thigh and perineum; tenderness over right ureter with palpation of a cord-like structure along course of right ureter. Cystoscopy.—Before first operation right hæmaturia; after operation papillary growth seen at right ureter orifice. Pre-operative Diagnosis.—Tumor right kidney; later tumor right ureter. Treatment.—Nephrectomy; later ureterectomy. Result.—Died. Pathological Findings.—Surgical specimen. Tumor lower right ureter. Microscopical.—Medullary carcinoma of right ureter.

Judd, Parker and Morse,[66] Surg. Clin. N. Amer., vol. vi, p. 1143 (1926).—Male, aged fifty-four years. Clinical Findings.—Pain in left loin three years before. Cystoscopy.—Negative; recurrence one year later with loss of weight and hæmaturia; later cystoscopy; small specimen of papillary epithelioma removed from right ureteral orifice. Pre-operative Diagnosis.—Papillary epithelioma of right ureter. Treatment.—Prostatectomy followed by nephro-ureterectomy. Pathological Findings.—Surgical specimen. Papillary tumor low down in right ureter. Microscopical.—Papillary epithelioma of right ureter.

K. Schule, Fortschr. a. d. geb. d. Roentgenatrahlen, vol. xxxvi, p. 825 (1927).—Female, aged sixty-one years. Clinical Findings.—Intermittent hæmaturia. X-ray.—Opaque shadow in region of left ureter. Cystoscopy.—Obstruction at fifteen centimetres left ureter with bleeding; no dye. Pre-operative Diagnosis.—Tumor of ureter. Treatment.—Nephrectomy and ureterectomy. Result.—Died second post-operative day. Pathological Findings.—Surgical specimen. Tumor in lower third of left ureter size of egg, with extension into adjacent structures; left hydro-ureter; left hydronephrosis. Microscopical.—Solid richly cellular carcinoma of ureter.

V. C. Hunt,[67] Surg. Clin. N. Amer., p. 1464, December (1927).—Male, aged sixty-four years. Clinical Findings.—Irritability of bladder; hæmaturia. Pre-operative Diagnosis.—Papillary epithelioma of lower third of right ureter. Treatment.—Nephro-ureterectomy. Result.—Well. Pathologcal Findings.—Surgical specimen. Right hydro-ureter; right hydronephrosis; tumor right ureter. Microscopical.—Papillary epithelioma of right ureter.

N. F. Ockerblad and F. C. Helwig,[68] Jour. Urol., vol. xxiv, p. 451 (1930).—Female, aged seventy-five years. Clinical Findings.—Chills; fever; pyuria; no hæmaturia; cured of carcinoma of nose with X-ray five years before. Cystoscopy.—Obstruction at right ureter at eight centimetres from bladder; no function. X-ray.—Mass. Pre-operative Diagnosis.—Infected hydronephrosis or perinephritic abscess first, then malignant retroperitoneal tumor. Treatment.—Incision and drainage of lower pole of right kidney, then X-ray treatment. Result.—Died. Pathological Findings.—Post-mortem. Right hydro-

nephrosis; right hydro-ureter; enormous tumor infiltrating surrounding structures involving middle third of ureter; tumor penetrating outer coat of duodenum. Microscopical.—Papillary carcinoma of ureter with metastases of liver.

L. M. Rousselot and J. D. Lamon,[69] Surg. Gynec., and Obst., vol. l, p. 1728, January (1930).—Female, aged forty-eight years. Clinical Findings.—Asthenia; pain left flank; fever and sweats; burning on urination; mass in left upper quadrant. Cystoscopy.—Floor of bladder pushed up by mass. X-ray suggest stone in left kidney. Associated Calculi.—Stone. Pre-operative Diagnosis.—Ovarian cyst; left renal calculi; left pyonephrosis and cystitis. Treatment.—Exploratory laparotomy; dermoid left ovary; cyst opened and drained. Poor condition of patient. Result.—Died thirty-one days later. Pathological Findings.—Post-mortem. Dermoid left ovary; tumor upper left ureter with cysts; left pyonephrosis with calculi; right ureteral calculus and right hydronephrosis. Microscopical.—Squamous-cell carcinoma of ureter.

R. D'Aunoy and A. Zoeller, Arch. Path., vol. ix, pp. 17–30, January (1930).—Clinical Findings.—Hæmaturia; negative physical. Ureteropyelogram.—Ptosis of right kidney; irregularity of filling; dilatation and kinking of right ureter with filling defect 1.5 centimetres below lower border of ileum. Pre-operative Diagnosis.—New growth of ureter. Treatment.—Ureterectomy, forty days; later nephrectomy. Pathological Findings.—Surgical specimen. Tumor of ureter (papillary). Microscopical.—Papillary carcinoma and right hydronephrosis.

Joseph B. Macalpine,[70] specimen of papillary carcinoma of ureter from a male, aged fifty-eight, Proc. Roy. Soc. Med., London, 1889 (1928). Male, aged fifty-eight years. Clinical Findings.—Pain in right loin and suprapubic region; hæmaturia. X-ray.—Negative. Cystoscopy.—Congestion of right ureteral orifice; no dye; obstruction at right ureter five inches from bladder. Treatment.—Nephrectomy and ureterectomy. Pathological Findings.—Surgical specimen. Tumor left ureter. Microscopical.—Papillary carcinoma.

Harry D. Morse,[71] primary papillary epithelioma of the ureter. Canad. Med. Assoc. Jour., Toronto, vol. xv, pp. 902–904 (1925).—Male, aged fifty-four years. Clinical Findings.—Pain in right lumbar region radiating to genitals; hæmaturia. August, 1921, stone removed from bladder. X-ray.—Negative. Cystoscopy.—Enlarged prostate; no obstruction of ureters; urines negative; function good. Right pyelo-ureterogram.—Dilatation of pelvis and calyces; two years later painless hæmaturia; loss of weight and strength. Cystoscopy.—Enlarged gland; right ureteral orifice swollen and covered with small tags. Biopsy.—Papillary epithelioma. Pre-operative Diagnosis.—Not stated. Treatment.—Prostatectomy followed later by hæmaturia. Cystoscopy.—Obstruction at right ureter at five centimetres; nephro-ureterectomy. Pathological Findings.—Surgical specimen. Right hydronephrosis; right hydro-ureter; pedunculated papilloma in lower right ureter. Microscopical.—Papillary epithelioma.

H. E. Simon,[72] papillary epithelioma of the renal pelvis and ureter associated with a huge hydronephrotic sac. Proceedings of staff meetings of The Mayo Clinic, vol. ii, No. 36, September 7 (1927).—Male, aged forty-six years. Clinical Findings.—Hæmaturia: gradual enlargement of abdomen. X-ray.—Negative. Cystoscopy.—Tumor at right ureteral orifice. Biopsy.—Squamous-cell epithelioma; right ureter not catheterized; no dye. Pre-operative Diagnosis.—Papillary epithelioma of right renal pelvis with implants in ureter and bladder and hydronephrosis. Treatment.—Right nephrectomy and removal of upper two-thirds of ureter; secondary ureterectomy planned. Pathological Findings.—Right hydronephrosis with tumor in ureter extending into pelvis. Microscopical.—Squamous-cell epithelioma.

P. A. Rohrer,[73] papillary epithelioma of the ureter. Jour. Urol., vol. xxiv, No. 6, p. 639 (1930).—Male, aged forty-nine years. Clinical Findings.—Left renal colic. Cystoscopy.—Obstruction at left ureter at one inch from pelvis; blood through catheter; reduced dye in left kidney. X-ray.—Plain negative. Left pyelogram.—Hydronephrosis with dilatation of upper part of ureter; following nephrectomy two years later. Cysto-

scopy.—Small papillary tumor near left ureteral orifice with blood through left ureteral orifice. Left ureterogram.—Filling defect. Pre-operative Diagnosis.—Ureteral calculus; later multiple papillomata of left ureter. Treatment.—Left nephrectomy; two years later hæmaturia and pain in left side; later ureterectomy. Result.—Well. Pathological Findings.—Specimen. Multiple abscess of ureter; three tumors; papillomata in character. Microscopical.—Papillary epithelioma of ureter.

Luigi, Caporale, primary carcinoma of the ureter with atrophic hydronephrosis. The Urol. and Cut. Review, vol. xxxv, No. 6, p. 341, June (1931).—Female, aged seventy-five years. Clinical Findings.—Intermittent hæmaturia for two months; pain in left flank and dysuria. Physical negative. Cystoscopy.—Polypoid vegetation over left ureteral orifice protruding from ureter each spurt of urine; later going back in again; no dye left. X-ray.—Negative; obstruction at left ureter at seven centimetres. Pre-operative Diagnosis.—Papilloma of ureter. Treatment.—Left nephrectomy and partial ureterectomy. Pathological Findings.—Surgical specimen. Dilated kidney pelvis; dilated ureter; tumor the size of a walnut in lower ureter. Microscopical.—Papillary carcinoma.

Rene Sommer,[74] primary carcinoma of the ureter with metastatic obstruction of the other ureter. Zeitschrift für Urologie, vol. xxvi, p. 1 (1932).—Female, aged sixty-one years. Clinical Findings.—Hæmaturia and tenesmus; sudden anuria four months. X-ray. —Suggested calculus in lower ureter. Cystoscopy.—Right ureteral orifice protruding into bladder; obstruction right ureter at orifice; left ureter at one centimetre. Pre-operative Diagnosis.—Stone right ureter. Treatment.—Right decapsulation and pyelotomy; kidney small. Result.—Died of uræmia. Pathological Findings.—Primary carcinoma middle third of right ureter with deposits in other parts of the ureter; left ureter was also blocked by carcinomatous deposit in centre. Microscopical.—Papillary carcinoma.

V. C. Hunt,[75] the necessity for operation in the ureter including ureterectomy subsequent to nephrectomy. Jour. Urol., vol. xxiii, pp. 43–54 (Case VI) (1930).—Male, aged forty years. Clinical Findings.—Intermittent hæmaturia; passed stone seventeen days ago. X-ray.—Negative. Cystoscopy.—Neoplasm left ureter orifice; occlusion left ureteral orifice. Associated Calculi.—Stone. Pre-operative Diagnosis.—Papillary epithelioma of the ureter. Treatment.—Left nephrectomy for pyonephrosis; exploration of ureter negative; eleven days later ureterectomy with resection of segment of bladder tumor eight centimetres. Pathological Findings.—Surgical specimen. Pyonephrotic kidney; tumor lower ureter. Microscopical.—Papillary epithelioma.

V. C. Hunt,[76] papillary epithelioma of renal pelvis. Jour. Urol., vol. xviii, p. 241 (Case XI) (1927).—Female, aged sixty-five years. Clinical Findings.—Hæmaturia two weeks; pain in right loin; loss of weight; physical history negative. X-ray and Cystoscopy.—Negative. Right Pyelogram.—Bizarre pelvis with filling defect, with moderate dilatation of ureter. Pre-operative Diagnosis.—Neoplasm of renal pelvis. Treatment.—Right nephrectomy with removal of upper third of ureter; tumor upper part of ureter; later complete ureterectomy. Result.—Died. Pathological Findings.—Surgical specimen. First operation squamous-cell carcinoma upper one inch of ureter; later ureterectomy; entire ureter filled with papillary carcinoma; no metastases.

P. E. McCown,[77] primary carcinoma of the ureter. Jour. Am. Med. Assn., vol. xciv. No. 7. (1930).—Male, aged forty-five years. Clinical Findings.—Headache and general malaise; physical history negative. Cystoscopy.—Left ureter obstruction at twenty centimetres. X-ray.—Left kidney larger than right kidney; hæmorrhage through catheter. Pre-operative Diagnosis.—Stricture left ureteropelvic juncture; later ureteral tumor. Treatment.—Left nephrectomy and partial ureterectomy. Result.—Died third post-operative day. Pathological Findings.—Surgical specimen. Papillary carcinoma upper third of left ureter.

F. Volante.[78] primary carcinoma of the ureter. Arch. Ital. d'urol., vol. iv, pp. 105–132, December (1927).—Male, aged forty-nine years. Clinical Findings.—Passed calculus at age of fifteen; hæmaturia for eleven years; pain in left flank three years ago. Physical

History.—Mass in left hypochondrium. X-ray.—Negative for stone. Cystoscopy.—Negative bladder; obstruction left ureter at two centimetres. Associated Calculi.—Calculus. Pre-operative Diagnosis.—Not stated. Treatment.—Left nephrectomy and partial ureterectomy; later ureterectomy; ureter tumor infiltrating pelvis. Result.—Died. Pathological Findings.—Surgical specimen. Pyonephrosis and pyo-ureter. Post-mortem. Papillary carcinoma of left ureter with pseudo-glandular characteristics; metastases in regional nodes, bladder and right lung.

L. P. Player,[79] primary ureteral carcinoma with review of literature with case report. Urol. and Cutan. Rev., vol. xxxii, p. 7, July (1928).—Female, aged sixty-five years. Clinical Findings.—Hæmaturia two years; pain in left side; loss of weight; frequency; physical history negative. Cystoscopy.—Two papillomata in bladder, one near left ureteral orifice; obstruction left ureter at sixteen centimetres from bladder; bleeding through catheter; no dye left. X-ray.—Negative. Pre-operative Diagnosis.—Neoplasm of left ureter probable left hydronephrosis. Treatment.—Left nephrectomy and partial ureterectomy. Pathological Findings.—Surgical specimen. Hydronephrosis left kidney. Microscopical.—Papillary epithelioma of ureter with extension into surrounding tissues.

B. A. Thomas,[80] in discussion of case of P. E. McCown.—Male. Clinical Findings.—Hæmaturia. Cystoscopy.—Papilloma; obstruction at ureteral orifice. Ureterography.—Filling defect. Side.—Not stated. Pre-operative Diagnosis.—Papilloma of ureter. Treatment.—Resection of lower end of ureter and part of bladder and reimplantation of ureter into bladder followed by secondary nephrectomy. Result.—Recovery. Pathological Findings.—Surgical specimen. Malignant papilloma of ureter.

B. A. Thomas,[81] in discussion of case of P. E. McCown.—Male. Clinical Findings.—Hæmaturia. Cystoscopy.—Bloody urine from one ureter. Ureterography.—Filling defect lower end of ureter. Side.—Not stated. Pre-operative Diagnosis.—Papilloma of ureter. Treatment.—Resection of lower end of ureter and part of bladder and reimplantation of ureter into bladder. Pathological Findings.—Surgical specimen. Malignant papilloma of ureter.

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SUPERNUMERARY KIDNEY*

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True supernumerary kidney is the rarest of the congenital renal anomalies. Martius[1] in 1656 was the first to describe a human subject having two kidneys on one side and a single kidney on the other. Blasius[2] in 1677 reported the second case. In 1915, Kretschmer[3, 4] reported his first case; and in 1929 a second case, and, in a complete review of the literature, collected twenty-eight others—making a total of thirty cases, which he summarized according to: symptoms; cystoscopical examination; pre-operative diagnosis; operation; pathology; and result. Papin, Bernasconi and Barnard[5] in 1931 reported a case and collected twenty-seven cases from the literature, which they considered authentic supernumerary kidneys. Lintz,[6] in 1932, reported a case of bilateral double kidney with duplication of ureters, diagnosed by intravenous pyelography, which has been classified by some as supernumerary; Hicks,[7] in 1932 resected the upper division of a supernumerary fused kidney. Pain and Eisendrath,[8] in their classification of renal and ureteral anomalies, in 1927, describe four types of multiple kidneys, *i.e.* (excess or supernumerary).

(1) Pseudo double kidney, *i.e.* single mass of parenchyme but two pelves and a single ureter.

(2) Two kidneys with two ureters uniting to form a single ureter.

(3) Two kidneys with two ureters opening separately into bladder.

(4) Two kidneys with ureter of upper opening into lower.

F. P. Johnson and Young[9] describe two varieties, free and fused.

(1) *Free* supernumerary kidneys are to be considered only in those cases in which there are found two entirely separate kidneys on one side with a normal kidney on the other. The supernumerary kidney always lies at a lower level than the normal one, and is frequently found in the lower iliac region or pelvis. Its form is usually somewhat distorted, its size smaller than normal. The usual explanation is that it is the resultant of a supernumerary ureteral bud. That it may also be due to the complete splitting of the renal anlage as in a case of double kidney is obvious, since cases of free supernumerary kidney have been described where the splitting of the ureter was incomplete.

(2) *Fused* supernumerary kidney is usually found in cases of double ureter and pelvis. The kidney is elongated and oftentimes shows evidence of a transverse sulcus which incompletely divides it into two parts, sometimes the sulcus is quite shallow or not indicated at all; at other times it is deep, leaving only a small bridge of renal parenchyma or connective tissue binding the two together. An analysis of this condition will show that it is quite

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similar to that of free supernumerary kidney. The difference being merely one of degree. Embryologically such kidneys are the result of splitting of a ureteral bud, or the development of two separate ureteral buds, with a single or incompletely divided primitive metanephrogenic cap.

FIG. 1.—Photograph of pathological specimen (No. E69, Department of Pathology, University of Maryland, Md.), showing fused supernumerary kidney, left, with separate blood supply, renal pelvis and ureter which crosses the mid-line and enters the right side of the bladder .5 cm. mesial to the right ureter. The fundus of the bladder is reflected downwards to show relationship of ureters as they enter the bladder.

I report an example of the latter type from the pathological museum of the University of Maryland, the photograph of which specimen is attached. (Fig. 1.)

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THE TREATMENT OF VARICOSE VEINS

A STUDY BASED UPON A SERIES OF MORE THAN 35,000 INJECTIONS OF VARIOUS SCLEROSING SOLUTIONS GIVEN IN 3,164 CASES, AND 293 CASES OF EXTENSIVE AND RECURRENT VARICOSE VEINS TREATED BY PRELIMINARY AMBULATORY LIGATION AND SUBSEQUENT INJECTIONS

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The treatment of varicose veins by the injection or sclerosing method, while a most valuable addition to our therapeutic armamentarium, is not the "cure-all" it promised to be when first presented to the medical profession of this country.

The majority of varicose-vein patients may be treated successfully by the injection method alone. However, there is a large group of patients which cannot be successfully treated by this method unless preliminary ligation or ligations are performed.

While this statement may appear somewhat dogmatic, it becomes an axiom to anyone engaged on a large scale in the treatment of varicose-vein patients. There is sufficient evidence in the recent literature to support this. de Takats,[1,2,3] Cooper,[4] Scheiber,[5] and Moszkowicz[6] have all reported on a sufficiently large series of cases to warrant such conclusions. As a matter of fact, one may go back as far as 1811 when Everard Home[7] noted the salutary effects of "including the saphena magna in a ligature above the knee in cases of chronic varicose ulcers associated with status varicosus."

According to de Takats,[1] the pressure in a valveless vein may be as high as 210 centimetres of water when standing. Ligation, therefore, reduces the pressure in a valveless vein and protects the thrombus formed after the injection from recanalizing.

Curiously, even radical excision of a varicosed saphena magna is frequently followed by recurrence unless high ligation of the vein is practiced. Homans[8] and Trout[9] report such occurrences.

At this point, I wish to stress again the importance of the same principle in the injection method of treatment, namely, thorough obliteration of a varicosed internal saphenous vein is frequently followed by recurrence unless high ligation is performed as a preliminary measure.

Assuming that a patient presents no contra-indications[10, 11, 4] to the injection treatment, and patency of the deep veins has been ascertained by means of the von Perthe test,[9, 12] or one of its modifications, how is one to proceed in the treatment of the case?

It is the writer's opinion that the first and most important step in this work is the classification of the patient by means of the Trendelenburg test so that the sources or points of reverse flow from the deep veins into the superficial veins can be accurately localized.

The correct interpretation of this test depends upon one's understanding of the dynamic principles of the normal venous flow, and the changes in such principles in status varicosus. Any attempt to proceed with treatment without the knowledge of the Trendelenburg status of a patient can lead only to indifferent results and recurrences.

The Trendelenburg Phenomenon or Test.—Berntsen[13] classifies the Trendelenburg phenomenon into four groups:

(*a*) Trendelenburg *positive* when the reverse flow from the deep veins into the saphena magna takes place at the saphenofemoral junction, or through one of the larger communicating veins in the lower part of the thigh.

(*b*) Trendelenburg *negative* when the back flow from the deep veins takes place through the incompetent communicating veins in the leg while the valves in the saphena magna in the thigh remain intact and competent.

(*c*) Trendelenburg *double*. This group embraces both of the aforementioned classes and is usually found in cases of very extensive varicose-vein formation. In this class there is a reverse flow of blood downward from the saphenofemoral junction as well as a marked reverse flow outward through the communicating veins in the leg.

(*d*) Trendelenburg *nil*. In this group there is neither a reverse flow from the saphenofemoral junction nor through the communicating veins in the leg. The veins in this group have dilated walls but the valve edges coapt and are competent, thus preventing back flow. This phenomenon represents an early stage in the development of varicose veins with dilatation of the vein walls in the presence of competent valves. The dilatation may finally develop so widely that the valves cannot coapt their edges and become incompetent, in which case the reverse flow develops and one of the other Trendelenburg states supervenes.

Ochsner[14] elicits the Trendelenburg sign as follows: The patient stands, allowing the saphena magna to fill and become prominent. Make firm pressure with the thumb of one hand on the lower end of the saphena magna; the blood is then stripped upward and if the vein remains collapsed between succeeding groups of valves, the valves are competent and the Trendelenburg sign is absent. If the veins fill from above, it is evident that the valves are incompetent and the Trendelenburg sign is positive or present.

Another method for demonstrating the Trendelenburg phenomenon is described by McPheeters.[15]

My method for demonstrating the Trendelenburg phenomenon is simple and for all practical purposes very satisfactory. The patient is recumbent and the limb to be examined is elevated above the body, thus causing the veins to empty and collapse. With the limb elevated, a series of tourniquets are then applied from the knee to the groin at intervals of about three inches with sufficient pressure only to block the flow in the saphena magna. The patient then stands on a platform. If the varices in the leg are large and yet fill very slowly and then only under slight tension, one may be certain that there is no back flow from the deep veins of the lower leg into the superficial veins through an incompetent communicating vein. With the patient still standing the tourniquets are removed, one at a time, from below upward. If the veins below any tourniquet remain collapsed the reverse flow must take place at some point above it. If the veins remain collapsed to the highest tourniquet, the only source of reverse flow must be the femoral vein at the saphenofemoral junction, through an incompetent saphena magna. This phenomenon is

classed as Trendelenburg *positive*. It is further proven when the highest tourniquet is removed and all the veins below it in the thigh and leg are seen to fill very suddenly and completely. The patient is classed as Trendelenburg *negative* if the veins of the leg fill very suddenly and under great tension when the patient stands with the tourniquets applied to the thigh. The Trendelenburg *double* group comprises those cases in which the combination of Trendelenburg positive and negative exists. There is not only a reflux of blood from the saphenofemoral junction through the saphena magna, but also from the deep veins through one or more of the communicating veins in the leg. When the tourniquets are applied and the patient is asked to stand, a rather rapid filling of the veins in the leg will be noticed. The tourniquets are then quickly removed and if the veins become more tense immediately after, one may surmise that the valves of the saphena magna are also incompetent. The Trendelenburg *nil* case represents an early stage in the development of varicose veins, with dilatation of the vein wall in the presence of competent valves. There is no demonstrable reverse flow in this group.

Indications for Ligation.—Having determined the Trendelenburg status of a patient one can readily decide whether or not to perform the preliminary ligation.

Trendelenburg *positive* cases are those in which the reflux of blood through the saphena magna in the thigh is marked and the valves, therefore, are incompetent. Ligation at the highest palpable point in the thigh, or at the fossa ovalis, is definitely indicated.

Trendelenburg *negative* cases are those in which the reflux of blood from the deep veins takes place through incompetent communicating vein or veins in the leg, the so-called "blow-out" veins of McPheeters. In this group one may proceed directly with the injection treatment without preliminary ligation. If, however, the veins are very large, it is my practice to perform a preliminary ligation at the highest palpable point in the leg at which a reverse flow can be demonstrated. While some workers may not agree with me as to the need or advisability of an ambulatory ligation in this type of case, I have found the procedure worth while and of definite value.

In the Trendelenburg *double* group and especially those with large and extensive varices, it is my practice to perform multiple ligations at all the demonstrable points of back flow. Formerly, this type of case was subjected to radical operative procedures, but in my hands multiple ligations with subsequent sclerosing injections have proven most successful.

Trendelenburg *nil* cases are injected without preliminary ligation.

How to Select the Proper Point for Ligation.—I usually combine several methods for determining at which point or points ligation should be performed.

The first method, that of Ochsner,[14] is described elsewhere in this paper. When performing this test, carefully observe each segment of vein as it is being stripped upwards. If the veins below the point at which finger pressure

is being applied should suddenly distend, it is evident that reverse flow has occurred and the site at which this happens is selected for ligation.

The second method, that of the writer, is carried out with the tourniquets applied to the limb from the knee to the groin at intervals of about three inches. The tourniquets are removed, one at a time, from below upward. If the veins suddenly distend when any one of the tourniquets is removed, then the source of the backflow is somewhere between this tourniquet and the one next higher to it. This test is repeated with the tourniquets applied a little closer so that the exact point of reverse flow may be localized. If the veins remain collapsed until the highest tourniquet is removed, and then suddenly fill and distend, ligation must be performed at the fossa ovalis or very slightly distal to the saphenofemoral junction.

The third method, known as McPheeters' percussion test, is a very convenient method for "tracking" or locating the saphena magna in the thigh, especially in obese individuals in whom the upper portion of the vein may not be easily visualized or palpated. The patient stands. Gently tap the prominent veins in the leg with the fingers of one hand. This will produce a pulse or pulse wave which is transmitted to the saphena magna in the thigh. By gently palpating along the course of the vein in the thigh with the fingers of the other hand, the position of the saphena magna may be accurately mapped out. The highest point at which the pulse wave is perceived is the site usually selected for operation. As a rule I do not rely on this method alone, but supplement it with the tourniquet test for greater accuracy in selecting the point for ligation.

After the site for operation has been selected, the skin should be marked directly over the vein and parallel to it for about one inch with an indelible pencil, a marking device preferred because of its convenience and the mark made with it is not easily removed by the usual methods of pre-operative skin preparation.

Technic of Operation.—The site for operation has been carefully selected by one or more of the methods heretofore described.

The thigh or leg is shaved and the patient is placed in the recumbent posture in which position I prefer to operate, although de Takats[1, 2] chooses to operate with the patient standing. The pre-operative skin preparation consists of painting with tincture of iodine followed by alcohol, or with a 3 per cent. alcoholic solution of picric acid. A ½ per cent. solution of novocaine is then injected into the skin and subcutaneous tissue in a line which crosses the marked vein at a right angle. Care is taken before the novocaine is injected to see that a vein has not been entered, since novocaine intravenously will cause a severe reaction and shock. This may be done by drawing up on the plunger of the syringe to ascertain the position of the needle before each injection. The skin and subcutaneous tissue are then incised along the line of novocaine infiltration and the deeper fat layer is separated with a blunt instrument such as a hæmostat. The vein should be readily recognized in the deeper layer of the fat or directly under it. The fascia of the vein is stripped off and the vein is carefully picked up with anatomical forceps. A hæmostat is then gently worked under the vein and the blades are spread, thus freeing the vein from its sheath or fascia. The vein is ligated with chromic No. 1 catgut at two points about one inch apart, and the intervening segment of vein is excised. Any com-

municating or collateral veins connected with the segment to be excised are also carefully ligated and cut. The vein stumps are dropped into the wound, the fascia is apposed with one or two catgut sutures and the skin is closed with several dermal or silk sutures, or skin clips.

In order to prevent massive thrombosis in the vein below the ligature, I apply a firm, spiral elastic bandage (the new Ace No. 8 is excellent for this purpose) from the ankle to the groin before the patient is allowed to alight from the operating table. The patient is instructed to apply the bandage each morning before allowing the limb to assume a dependent position.

The after treatment is no different from that of any other operative wound, the sutures being removed on the fifth to seventh day as a rule, at which time I usually begin the injections of sclerosing solution.

If the vein is ligated at the proper point, the first thing noticed when the patient alights from the operating table is the almost complete collapse of the veins below the ligature and the patient will promptly comment on the feeling of lightness in the limb which formerly was heavy and tired.

Choice of Sclerosing Solution.—The recent literature on sclerosing solutions for the injection treatment of varicose veins is replete with the advantages and disadvantages of each agent.

Perhaps the most widely used sclerosing agent of all those recently offered is sodium morrhuate 5 per cent. In December, 1932, I[16] reported on the use of this substance in the treatment of more than 600 patients with approximately 4,000 injections. Up to the present time I have used sodium morrhuate 5 per cent. in a considerably larger series of cases. The results I have obtained with it are excellent and agree in almost all respects with the results reported by Levi,[17] Smith,[18] Tunick and Nach,[19] and Higgins and Kittel.[20]

At the present time, I am also using a new combination of sodium morrhuate 5 per cent. with quinine alkaloid 2 per cent. and benzyl alcohol 2 per cent., but I have used this new preparation in too small a series of cases to warrant any definite conclusions.

Technic of Injection with Sodium Morrhuate 5 Per Cent.—The quantity of sodium morrhuate 5 per cent. that may be injected at one sitting should never exceed five cubic centimetres.

The skin at the site of injection is prepared with tincture of iodine followed by alcohol.

Those cases presenting very large varices are treated according to the method of McPheeters,[21] namely, isolation of a segment of the vein between tourniquets after the vein is emptied by elevation of the limb, the patient being in a recumbent position.

The vast majority of patients, however, are treated while standing on a table or platform about twenty-seven inches high. Standing renders the veins more prominent. A five-cubic centimetre Luer syringe fitted with a sharp, short bevel, 25-gauge needle is then gently but firmly pushed through the skin into the vein with needle pointed upward. The position of the needle in the vein is quickly ascertained by the presence of blood which trickles through the needle into the syringe. If the vein is small the injection is given without further preparation; if medium sized or larger, the vein is milked with the thumb and middle finger of the left hand, or by an assistant, after which the injection is given.

I usually inject from 0.5 to 3 cubic centimetres of the solution at any one site and as a rule place the first injection at the highest point in any vein or group of veins.

As soon as the desired quantity of solution is injected, a tonsil sponge moistened with alcohol is placed firmly over the site of puncture and the needle is withdrawn. An adhesive strap about seven inches long and one inch wide is then placed over the sponge, binding it firmly over the injected area. The patient is instructed to remove the dressing after forty-eight hours and not to massage or rub the limb at the point injected.

Injections may be repeated every second day and in the intervals between treatments the limb should be kept snugly encased in a spiral elastic bandage.

Comment.—During the past few years I have performed the Trendelenburg operation (ambulatory) as a preliminary measure in 293 cases and I have given more than 35,000 injections of various sclerosing solutions in the treatment of varicose veins.

The patients selected for preliminary ligation were those who presented very large and extensive varices with marked reverse or back flow as well as those with recurrent veins. My experience with this type of case, treated with injections alone, had proved somewhat disappointing, chiefly from the standpoint of recurrence. It became apparent to me several years ago that a permanent cure could not be effected by injections alone and that the ambulatory ligation, so warmly advocated by de Takats, was a sound procedure based upon a logical consideration of the altered dynamic principles of the blood flow in the veins of the lower extremity.

The patients selected for injections without preliminary ligation were those who presented either larger or small varices with no evidence of marked reverse flow.

SUMMARY.—Sodium morrhuate in 5 per cent. strength will not cause toxic symptoms when used in the proper quantity.

Sodium morrhuate will not produce an ulcer or slough if accidentally injected into the perivenous or subcutaneous tissues.

Sodium morrhuate will not produce an infectious phlebitis if a proper, aseptic technic is observed.

The objectionable symptoms (pain, cramp and systemic reactions) and sequelæ (sloughs, residual discoloration and nodulation) resulting from the injection of the other solutions will not occur with the use of sodium morrhuate.

Five per cent. sodium morrhuate meets with all the requirements for a safe and effective sclerosing agent in the injection treatment of varicose veins.

Not a single instance of recurrence was noted in a series of 293 cases of extensive and recurrent varicose veins treated by preliminary ambulatory ligation and subsequent injections.

All patients were ambulatory and no time was lost from gainful work.

Immediate symptomatic relief was noted in nearly every case after ligation.

Following ligation, complete thrombosis or occlusion was noted in 4 per cent. of the cases, so that no injections were necessary. A radical cure was thus obtained by this simple procedure alone.

After ligation the veins are partially collapsed so that smaller quantities of the sclerosing solution can be used with as great or greater effect, than when the vein is distended with blood.

The number of injections required for satisfactory obliteration of varicose veins after ligation is markedly diminished.

The sclerosed vein after ligation and injections disappears more quickly and completely than when treated by injections alone.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD APRIL 12, 1933

The President, Dr. John Douglas, in the Chair

TONSILLECTOMY, BRONCHIECTASIS, LOBECTOMY

Dr. Frank B. Berry presented a woman, aged thirty-nine, who was admitted to Bellevue Hospital May 25, 1932.

In the preceding January, 1932, she had a tonsillectomy. Three to five days after the operation a large swelling developed in the right tonsillar region. This drained into the mouth and about the same time she began to cough and bring up large quantities of foul sputum. She has had two or three small hæmoptyses and lost eighteen pounds in weight. She left the hospital after three months. Since then she has regained ten pounds but has continued to expectorate. Sputum now amounts to twelve ounces a day and she complains of slight pain in the left back.

Physical Examination.—Negative except for left chest where there was dullness from the second to eighth spines posteriorly and over the middle third anteriorly. Over this area there was bronchovesicular breathing and a few râles were heard at the base. The bronchoscope showed pus from left lower lobe bronchus, with bronchiectasis of left lower lobe.

Course.—Pneumothorax on left started June 2, 1932, and left phrenic crushed on the same date. First-stage lobectomy June 14. Portion of ninth rib removed and sixth, seventh and eighth ribs divided at angles. Chest opened. Upper lobe collapsed. This and parietal pleura rubbed with gauze. Lower lobe found adherent to pericardium and diaphragm; this was completely mobilized. Wound closed without drainage. June 15 200 cubic centimetres bloody fluid aspirated. June 16 500 cubic centimetres bloody fluid aspirated. Smooth convalescence.

June 28.—Second stage. Both lobes adherent to chest-wall. Lower lobe mobilized. Payer clamp applied at root and lobe amputated. Stump transfixed and ligated and wound packed loosely with iodoform gauze. Temperature 101° and pulse 130 the night after operation. Five hundred cubic centimetres blood given. Smooth convalescence and patient returned to chest service August 16, 1932, with wound healed and no cough.

December, 1932.—Follow-up. Occasional dry cough. Lungs clear and resonant.

TUBERCULOSIS. THORACOPLASTY. HÆMORRHAGES TWO YEARS LATER. EMERGENCY THORACOPLASTY

Doctor Berry presented a woman, aged twenty-four, who was admitted to Bellevue Hospital January 15, 1931. She had been coughing blood for two days. She had a history of tuberculosis for five years. Thoracoplasty in three stages at another hospital in 1929. Improved for a short time but cough returned and since has been a semi-invalid. Three days before admission she had an hæmoptysis of several ounces and this was repeated the day before admission.

Sputum positive for tubercle bacilli. X-ray showed inadequate thoracoplasty with a fibrocaseous lesion.

Course.—Hæmoptysis continued several times a day in one- to three-ounce amounts. Temperature dropped to 100°. Phrenicectomy January 21, 1931, without benefit. Hæmoptysis increased to four- to six-ounce amounts and tended to recur every other day.

January 27, 1931, upper stage thoracoplasty under local anæsthesia. Patient had an hæmoptysis and a convulsion during the operation. Former operation revised and large segments of the first six ribs removed.

Temperature to 104° and pulse to 140 immediately following operation but dropped promptly to 102° and 120 and continued down. Convalescence smooth although there were several small hæmoptyses during the first few days. Transfusion.

Second stage of thoracoplasty revision performed March 3, 1931, with removal of lower ribs. This was preceded by a transfusion of 500 cubic centimetres. Smooth convalescence and wound healed well. Returned to chest service and from there went to a sanatorium for further convalescence. Sputum became negative and has remained so. Now has very little cough or sputum and is allowed to do as she wishes.

Case presented to show the failure of an inadequate thoracoplasty and the response to a proper type of thoracoplasty which was performed as a life-saving procedure for continuing hæmoptyses.

PYOGENIC-TUBERCULOUS PYOPNEUMOTHORAX WITH BRONCHIAL FISTULA

Doctor Berry presented a man, twenty-four years of age, who was admitted to Bellevue Hospital August 20, 1929, with cough and expectoration, and a history of tuberculosis for nineteen months before admission. Lesion confined to left side and pneumothorax started. Fluid present since inception of treatment. Three months before admission he began to bring up small amounts of non-foul, bad tasting fluid on stooping over. During this time lost ten pounds. Gentian violet injected into pleural cavity is brought up in the sputum.

Physical examination, negative except for signs of a pneumothorax with effusion in left chest. Sputum positive for tubercle bacilli. Thick green pus aspirated from chest. X-ray in complete collapse of left lung with fluid present. Right lung clear.

Course.—Patient did poorly and September 19, 1929, a catheter was inserted through the ninth space into the left chest. Tube drained well and chest was irrigated gently with mercurochrome and boric acid.

October 3, 1929, extensive resection of upper four ribs under local anæsthesia. Wound healed well and patient did well although he ran a septic temperature, at times to 102° and 103°.

November 12, 1929, extensive resection of third to eighth ribs inclusive. Patient did well and temperature and pulse gradually subsided except for occasional flares.

December 28, 1929, ninth to eleventh ribs inclusive resected. Bronchial fistula still open. Wound healed well about sinus tract to empyema cavity. From January to late March, 1930, he ran a low-grade, irregular temperature thought to be due to a slight infiltration of the right middle lobe. In October, 1929, weight was 112 pounds. By April, 1930, it was 130 pounds. By August, 1931, his weight was 148 pounds. Still wearing a tube. Sputum negative. Wound closed in October, 1930.

January 13, 1931. Two small abscesses developed recently near old sinus tract. Operation showed a small pleural cavity in axilla. Third to seventh anterior rib ends removed. Wound closed and drained. Did well and went home on the eighteenth day. Two more small operations of the Schede type were necessary before permanent closure was effected, one November 9, 1931 and the last, his sixth, on March 6, 1932. This consisted of merely laying open a short sinus tract. This healed in May, 1932. Since then he has remained well, weighs about 180 pounds, and is working.

Case presented because it presents one of the worst complications of pulmonary tuberculosis—spontaneous rupture of the lung with the development of a bronchial fistula and pyogenically infected tuberculosis empyema. This responded to radical surgery and then persistence in pursuing and eradicating the resultant sinus. In addition he developed and healed a small area of tuberculosis on the opposite side during his convalescence.

Dr. Howard Lilienthal called attention to the rapid onset, in the first case, of the coughing up of pus. It is rare to have the symptoms come on so suddenly as they usually occur about two weeks after tonsillectomy. As to the various methods of drainage. In this case there was no drainage after the first stage lobectomy. After the second stage when the lobe was excised the wound was packed loosely with iodoform gauze. Doctor Lilienthal called attention to the advantage in lobectomy of suction with no packing after the lobe has been removed. He uses a valve suction and there has been no mortality among his last four cases. Two are entirely well and two have a bronchial fistula although this was present before he operated on them and the fistulæ may be expected to close spontaneously. In Doctor Berry's third case, Doctor Lilienthal called attention to the advantage of carefully graded work in thoracoplastic operations. He does not believe it is necessary to take out large sections of the first rib; there are certain disadvantages in doing that. It takes longer and there is always the danger of injuring one of the large vessels as they cross over the first rib. After it has been denuded of periosteum it gives a good support for the operator's hand when pushing down the pulmonary apex. Regarding the case of the woman who had the hæmorrhages, Doctor Lilienthal thought it sometimes wise in these cases to have the patient bronchoscoped to show where the hæmorrhage is coming from; this may make a difference in what is to be done. The blood may come from a bleeding ulcer of the bronchus. As to the use of thoracoplasty for the checking of hæmorrhage, this is an excellent measure. In a case with active hæmorrhage brought in an ambulance a distance of one hundred miles, Doctor Lilienthal did a first-stage (upper) thoracoplasty and the bleeding immediately ceased and did not recur. Regarding the convulsion which the second patient had during the upper stage of the operation, Doctor Lilienthal believes in operating in all these cases where there is manipulation of the pleura with the patient's head lower than his chest. Most of these convulsions, probably all of them, occur from emboli and usually air emboli in the brain. (Schlaepfer's theory.) As to the shortness of breath, that

is not due to the amount of lung put out of commission. It may be caused by a pull on the mediastinal structures, and it is usually cardiac.

GALL-STONES IN WOMEN

Dr. Edward D. Truesdell presented four patients illustrating features of his paper "Incidental Gall-stones in Women" read before the New York Surgical Society a year ago.

Case I.—Was a young woman, seventeen years of age, who was referred to the Lincoln Hospital in August, 1932, by her family physician as a case of acute appendicitis. There had been a history of five months of attacks of abdominal pain. This diagnosis was concurred in by the admitting physician at the hospital, two members of the surgical interne staff, an associate attending surgeon and the assistant attending surgeon who operated upon the patient. At operation a greatly distended gall-bladder was uncovered containing a large quantity of turbid fluid, a dozen or fifteen small stones and putty-like material. It was thought best to drain the gall-bladder at the time. A month later the gall-bladder was removed by the speaker because of continued pain, evidences of persisting inflammation and because it was felt that it would be necessary to do so eventually in any case. Doctor Truesdell presented the case as an example of gall-stones in a young woman of seventeen years where, because of the patient's age, it was generally assumed that the symptoms were those of appendicitis and disease of the gall-bladder was not even considered. It was his opinion that many patients developing symptoms of gall-bladder disease during middle-age were possessed of gall-stones that had had their incipiency during the second and third decades of life, and had remained quiescent for long periods of time, as brought out in his paper. While cases of gall-stones under twenty years of age are reported from time to time, these represent chiefly the cases that have developed acute symptoms and must be considered as only a proportion of the number of cases actually originating and existing during this period of life. He felt that gall-stones might be more frequently diagnosed in the younger patients were the possibility of the existence of this condition held more prominently in mind. It would seem probable in the case of the patient presented that the gall-bladder might have been palpated under ether relaxation had the attempt been made.

Case II.—Was a woman, forty-three years of age, who had married at the age of fourteen years and had had seven pregnancies, three of these before the age of twenty years. Symptoms of gall-stones had developed at the age of thirty years, which persisted at intervals for six years when she was operated upon for the removal of her gall-bladder. This was said to have contained gall-stones and to have been removed. The operation had not been performed during an acute attack. One year after this operation, or six years ago, her symptoms recurred and gradually increased in severity, having been exceedingly severe during the past few months. At operation the gall-bladder fossa was found filled with omental adhesions which also extended to the region of the gastrohepatic omentum and duodenum. These were separated with some difficulty and a small pouch-like structure uncovered containing a medium-sized round gall-stone. This was continuous with a normal appearing cystic dust. This case was presented as an example of marriage with multiple pregnancies at an early age and the probable development of gall-bladder disease during the second or third decade of life even though definite symptoms of gall-stones did not appear until the patient was thirty years old. The case was of particular interest to him as an example of incomplete cholecystectomy, the ampulla of the gall-bladder and a stone the size of a small marble having been left behind, as was no doubt the case in view of the normal cystic duct. In his paper of the year before, Doctor Truesdell had expressed himself as opposed to the removal of the gall-bladder when this operation was superimposed upon any other of considerable extent. He felt that operations upon the gall-bladder were of sufficient importance and difficulty to entitle them to a separate procedure in the majority of cases and should not be merely incidental to some other operation when

the time already consumed, and the patient's condition might be a cause of hasty and inadequate procedure. Gall-bladder operations not infrequently turn out to be difficult and complicated which when begun had seemed to be simple, and it is of great importance that at the first attack upon the biliary structures a complete and satisfactory operation be performed through an incision advantageously located, and not through an incision located for some other operation even if extensively and unduly extended.

CASE III.—Was a woman twenty-eight years of age who had been married at twenty but had had no pregnancies. At the age of twenty-two years she developed quite typical attacks of biliary colic marked by severe abdominal pain, nausea and vomiting. Five weeks before, he had removed her gall-bladder containing ten medium-sized faceted gall-stones and fragments of still others. Four years ago, or two years after the development of her gall-bladder symptoms, she had undergone a gynecological operation, the appendix was removed and also a cyst of the ovary, and a ventrosuspension performed. It was reported that the gall-bladder had been palpated through the lower abdominal incision and that no gall-stones had been felt, although it would seem most improbable that they were not present at the time.

CASE IV.—Was a woman twenty-four years of age who had been married at eighteen years and had had two pregnancies. At the age of twenty-three years, or one year ago, she began to have attacks of acute abdominal pain. These attacks persisting for eight months, she had undergone a gynecological operation in September, 1932, the appendix being removed. It was reported that the gall-bladder had been palpated through the lower abdominal incision but that no gall-stones had been felt. The attacks of pain continuing, she was admitted to the Lincoln Hospital in January, 1933. Through a gall-bladder incision the gall-bladder was found to be free of adhesions, although the gall-bladder wall showed evidences of pathology. Only after prolonged and very careful palpation of the gall-bladder was it possible to discover what was thought to be a solitary, small, shot-like stone. After the removal the gall-bladder was found to contain some sixty-five very small round stones. Even with the advantage of an incision directly over the gall-bladder, the stones had almost escaped detection because of a rather large gall-bladder with a considerably thickened wall and a quantity of very thick mucilaginous bile which did not escape from the gall-bladder upon moderate pressure.

These last two cases were presented to show two young women who had married early in life, one of whom had had pregnancies and both of whom had developed gall-bladder symptoms at an early age. In both cases the gall-bladder had been palpated through a lower abdominal incision and in neither case had gall-stones been detected. It would seem that in the first case stones readily palpable had escaped detection because of unfamiliarity with the manœuvre, but in the second case stones barely palpable through a gall-bladder incision might readily have escaped detection by palpation through an incision in the lower half of the abdomen. In his paper, Doctor Truesdell had reported thirty-one women possessed of gall-stones among 350 women whose gall-bladders he had palpated during the course of an abdominal operation. In none of these had the presence of gall-stones been suspected before operation. This was an incidence of approximately 9 per cent. of the cases examined, which had seemed exceedingly high. However, it was maintained that this might be even lower than the actual occurrence of gall-stones among these 350 patients, since it would seem not improbable that gall-stones present had escaped detection by palpation alone in one or more cases, particularly when the incision was not advantageously located for this procedure. It was also pointed out that six of these thirty-one

women, or 19 per cent., of the entire number, were twenty-nine years of age or younger. This would seem to support the supposition that gall-stones had their origin in the latter part of the second decade or in the early part of the third more frequently than realized, and that one or more pregnancies early in life might favor the development of gall-stones even if not being directly responsible for them.

Dr. Joshua E. Sweet said that the one thought that occurred to him was that Doctor Truesdell, in presenting his interesting cases, said that he found "gall-stones." One can think, off-hand, of at least six different kinds of gall-stones which would indicate at least six different varieties of metabolic disturbances resulting in gall-stones. For fifty years surgeons have been in the habit of sending their gall-bladders to a pathologist who has sectioned the gall-bladder, returned a microscopical report, and aparently poured the gall-stones down the sink. The speaker thought the surgeon should be able to write the microscopical report himself after his study of the gall-bladder during removal, and so at least save the patient some of the high cost of medical care. In the time thus saved to a pathologist, he might pour the gall-bladder down the sink, and learn more by a study of the stones.

Dr. Henry F. Graham remarked that Doctor Truesdell had emphasized the fact that many patients were young. On the speaker's service recently there was a patient nine years of age with acute cholecystitis. There are cases in the records of gall-stones in the newborn so age is not a significant factor. As to the etiology, Joshua Sweet has said he believes the metabolism of vitamins comes into this. Many consider it a question of infection of some kind in every case. One man who has done a great deal of experimenting found that 50 per cent. of women who are pregnant show a bacilluria. The wisdom of performing only one operation at a time in a case where two operable conditions exist has been shown by The Mayo Clinic; the mortality was doubled when two operations were done at one time. As to the technic, if the gall-bladder is going to be examined for stones, it is better to do it at the beginning of the operation instead of at the close because of the increased danger of infection. Also if novocaine is used for spinal anæsthesia it gives the patient a chance to come out while the surgeon is examining in the upper abdomen.

Dr. Howard Lilienthal said that some years ago he had a girl patient eleven years of age whose gall-bladder he removed because of multiple pigment stones.

Doctor Truesdell, in closing the discussion, said that on the basis of the experience obtained in collecting the material for his paper he had become greatly impressed with the tendency of gall-stones to remain quiescent in the gall-bladder for considerable periods of time. He believed for this reason that cases of gall-stones encountered from time to time during the early years of life were, because of their acute symptoms, only a part of those

originating and existing during this period, many not asserting themselves until the fourth or fifth decades. He had also been impressed with the ease with which gall-stones escaped detection by palpation through an abdominal incision; such factors as the size of the gall-bladder, the condition of its wall, the size and number of the stones, the consistency of the bile, and the ease or difficulty with which the gall-bladder emptied upon pressure, all having much to do with the detection of stones present.

HÆMANGIOMA OF SPLEEN

Dr. Otto C. Pickhardt presented a man, thirty-three years of age, who was admitted to Lenox Hill Hospital in September, 1929. He had enjoyed good health up to about a year before admission. During the year of 1928, he had had mild attacks of abdominal discomfort described as cramps in the lower abdomen. At first these attacks occurred several times a week, later becoming less frequent and occurring only several times a month. About six months before entering the hospital he had noticed swelling of the ankles and puffiness of the eyelids and at about the same time a yellow tinge to the skin had become apparent. This was followed by gradual general weakness for which he sought relief. Another symptom that to him was very important was his impotence.

On physical examination a mass was found occupying almost the entire left side of the abdomen and extending as far as McBurney's point on the right side. In the left upper quadrant there was a definite bulging of the mass which shaded off to a deep oblique groove in the left lower abdomen. The mass was moderately movable and not tender.

On X-ray examination this mass was found to have pushed the stomach and descending colon to the right. No organic disease was noted in the gastro-intestinal tract. A pyelogram demonstrated a normal left kidney outline and normal filling of the calyces. Chest examination was negative.

The blood count on admission was 3,440,000 red blood cells with 55 per cent. hæmoglobin. The leucocyte count was normal. Blood smear examination showed anisocytosis, poikilocytosis and polychromatophilia. Wassermann negative; blood grouping II Jansky; urine and blood chemistry essentially normal; icterus index normal; temperature normal.

Blood-picture did not help in making a diagnosis. A provisional diagnosis of tumor of spleen was made and five deep X-ray therapy treatments were given. There weas immediate recession of the size of the tumor, but this lasted only a short time and within a few weeks the mass had grown to its former tremendous size.

In order to prepare for operation, a transfusion of 500 cubic centimetres of whole blood was given and here the first peculiar symptoms showed themselves. Immediately after the transfusion the patient had a rise of temperature to 105°, but without chills and without showing blood in his urine the next day. The reaction lasted forty-eight hours following which there was a return to normal. The following week, using another donor, transfusion of 500 cubic centimetres was repeated and again the patient had the same reaction—very high fever without chills and with a negative urine. It is needless to say that meticulous care had been taken to group and cross-group both patient and donor.

On November 13, 1929, splenectomy was performed. On opening the peritoneum, no fluid appeared. The spleen appeared as a greatly enlarged mass, deep red to purplish in color, with numerous rounded protuberances of

varying sizes. It was firm in consistency. There were only a moderate number of adhesions. The weight of the spleen and blood immediately after the operation was 2,600 Gm.

While still on the operating table, immediately post-operative, a transfusion of 500 cubic centimetres of whole blood was given, using one of the same donors from whom blood had been taken before. But now there was absolutely no reaction similar to the previous experiences. In fact, post-operative, the patient never ran a temperature above 100°, and that for only forty-eight hours, when it became normal. One could feel that something had been removed from this patient that had a destructive action on his red blood cells. The general post-operative course was quite uneventful, and within a month the patient was discharged from the hospital.

The organ removed consisted of two separate pieces. (*a*) A spleen, measuring 30.6 by 14.8 by 6.5 centimetres and weighing 2,020 Gm. It is irregular and very nodular, the nodules varying considerably in size and consistency; some being soft and feeling very cystic, others firm and hard. The spleen tissue itself felt fairly firm in consistence. On section, the organ is quite definitely lobulated, with prominent fibrous strands running throughout the structure. The chief characteristic of the tissue is its spongy appearance, due to the presence of open minute spaces in it. There are some depressed areas, and others slightly raised. The color also varies—many of the nodular areas appearing darker than the surrounding splenic tissue.

Sections of the spleen show microscopically multiple hæmangiomata of different sizes, separated by varying amounts of sclerotic splenic tissue. The tumors are usually poorly demarcated, though some of the smaller growths are circumscribed, but are not encapsulated. The structure consists of dilated, thick-walled sinusoids lined with prominent proliferating endothelial cells and filled either with blood or serum mixed with blood cells, lymphoid cells, desquamated endothelial cells and phagocytic cells containing erythrocytes or blood pigment. These vessels vary widely in size from very small calibre channels to wide irregular spaces often showing papillary ingrowths. The vessel walls contain varying quantities of lymphoid cells, blood and intra- and extracellular blood pigment. The uninvolved splenic tissue shows generalized thickening of the reticulum, with a reduction in the lymphoid cells and atrophy or disappearance of the Malpighian bodies. In localized areas, there is the formation of dense scar tissue. The capsule and trabeculæ also show fibrous thickening.

Section of a fragment from the liver shows slight cirrhosis of many of the sinusoids, associated with parenchymatous degeneration or fatty infiltration of the liver cells. The dilated sinusoids are usually free from blood. The capsule of the liver is slightly thickened by fibrosis, and there is slight increase in the interlobular fibrous tissue. Scattered through the fibrous tissue are collections of small round cells.

A follow-up of his blood-picture shows that he has a polycythæmia and that his blood platelets have risen from a pre-operative count of 15,000 to at present 250,000.

Two years post-operative the patient was readmitted to the hospital with a moderate jaundice which was diagnosed as a simple catarrhal jaundice. All examinations for bilhiasis were negative.

The two symptoms of which he now complains are (1) impotence; (2) tremor of hands.

This man is well after three and one-half years without evidence of metastases and one may conclude that this was probably in him a benign condition.

Dr. William Crawford White said that he had looked up the records at Roosevelt Hospital and could not find a single record of such a case. Charles E. Peck reported a case of hæmangioma of the left lobe of the liver about ten years ago which was interesting from the standpoint of the differential diagnosis. The gastro-intestinal series showed the stomach pushed down and the colon pushed down with it. At the time of the operation he was not sure he was dealing with the spleen or the liver.

Dr. Allen O. Whipple asked two questions: (1) whether the blood-vessels in the hilus of the spleen showed marked abnormality and, (2) whether there was present the physical sign of doughiness and pitting at the time of palpation. At the Presbyterian Hospital there have been cases of hæmangioma of the liver in which applied pressure showed a temporary pitting. Doctor Whipple also asked if there were thrills or bruit; these are points described by Alesandri of Rome in hæmangioma of the liver.

Doctor Pickhardt, in closing the discussion, said that to the best of his knowledge there was no elasticity in this particular tumor. It was of great size. There was no bruit and no thrill. He listened for that for he felt there was something peculiar about the mass, but the diagnosis of hæmangioma was not made because this was the first case of hæmangioma of the spleen ever seen in the Lenox Hill Hospital. As far as the blood-vessels were concerned no observation was made at the time of operation, entire attention being concentrated on the problem of getting the spleen out. However, they were not friable and came out without much difficulty. There was no mass of varicosed veins.

PLEURO-DIAPHRAGMATIC CYST

Dr. Otto C. Pickhardt presented a woman, fifty-three years of age, who was admitted to Lenox Hill Hospital in January, 1931. She had been complaining of sharp pain, knife-like in character, over the precordium for a period of several weeks. She also described a slight steady pain over the left lower antero-lateral region of the chest. Two years before admission she had been told she had a pleurisy on the left side and she described her recent complaints as being quite like those at the time of her previous illness.

Clinical signs were not definitely diagnostic, chest examination being essentially negative. X-ray examination revealed the presence of a circular shadow just above the left diaphragm. A thorascoscopy with the aid of a Jacobeus thoracoscope was done under local anæsthesia and there could be seen a tangerine-sized, yellowish, smooth, glistening tumor mass in the left pleural cavity. Better vision was obtained after the production of an artificial pneumothorax. A second X-ray examination at this time with the lung in a state of collapse showed the spherical mass separated from the heart shadow and lying in intimate relation with the diaphragm.

Thoracotomy was advised and after an interval of several months patient returned to the hospital for this procedure. Under general anæsthesia thoracotomy through the left eighth intercostal space was done.

The two operative procedures were recorded as follows:

(1) In the anterior axillary line of the left side, at the ninth interspace, a small nick is made in the skin and a Jacobeus trocar inserted into the pleural

cavity. Obturator removed and replaced by eye-piece. This eye-piece is gently inserted under direct vision and pushed antero-medially until it reaches the area of the left pleural cavity where the diaphragm, the anterior parietal pleura, the mediastinum and the pericardium meet. Here may be seen a tangerine-sized, yellowish, smooth, slightly lobulated, tumor mass, which glistens. The lung impedes the vision although not attached to the mass and therefore through the seventh interspace a needle is inserted and artificial pneumothorax induced. The globular mass may now be seen to better advantage and is found to have smooth edges; appears to be moderately pedunculated, although the base cannot be seen definitely because of the overhanging edges. Running over the glistening pleural covering are numerous blood-vessels. It does not pulsate within itself but it moves secondarily with spasmodic jerks. In appearance it suggests a lipoma, although, as this is the first view of an intrapleural mass with this instrument, only the findings should be described and the diagnosis left for an exploratory thoracotomy which is advised.

(2) An eight-inch incision is made through the left eighth intercostal space with fracture of the eighth and seventh ribs at that angle posteriorly.

The lung appears normal but has pleuritic adhesions posteriorly. The diaphragm is normal in its centre. At the anterior inferior medial aspect, in the costophrenic angle, at the junction of the diaphragm, apex of the pericardium and thoracic cage, there is seen a thin-walled cyst, the size of an orange, with a small, nipple-like projection towards the pericardium. This is covered by diaphragmatic parietal pleura and medially by fat pads from the pericardium. (It was this fatty appearance that gave rise to the possible diagnosis of lipoma at the time of the thoracoscopy several months previous.) Where this cyst lay tightly up against the ribs and costal cartilages anteriorly, a line of cleavage is found with the finger, and the cyst is then easily shelled out, leaving a raw area inferiorly on the muscle of the diaphragm. This area is easily covered by the diaphragmatic pleura which had covered the cyst, the free edge being sutured down by three interrupted plain gut sutures. Very little bleeding occurs, and it is decided not to drain.

The wound is closed, first by approximating the seventh and eighth ribs with several surrounding chromic sutures, and then the muscle layers closed separately with chromic sutures, and finally the skin with interrupted silk. During this procedure the lung is blown up several times so as to touch the chest wall.

The lung and pleura are everywhere normal in color and texture. There is no pleural effusion whatsoever. The portion of the pleura which covers the cyst, and is raised by it, is shiny and normal in appearance. The shelling out of the tumor is easily accomplished.

The pathological diagnosis was pleural cyst, probably of endothelial origin.

The thin-walled cyst was about 8.9 centimetres in diameter, roughly globular in shape. There is a main cystic mass and a smaller one about 1.5 centimetres in diameter. There seems to be no direct connection between the two cavities. There are a number of strands of muscle along one aspect of the main mass.

Microscopical Examination.—Section of the small cyst shows a very thin wall composed of dense, laminated fibrous tissue, the greater part of which is acellular or hyaline. The outer part of the wall is looser and rather rich in small cells resembling lymphocytes. The blood-vessels are very scanty. The inner surface is covered with small, deeply staining cells of the type of endothelial cells.

The post-operative course was uneventful, and the patient made an easy recovery, leaving the hospital within three weeks. She had a little temperature for a few days and had possibly more pain for several weeks after the operation than she had had before. Clinically, the application of diathermy gave her the greatest relief, and I believe helped to restoration to normal of the affected area. Follow-up X-rays show that there is now a perfectly normal and clear lung field with possibly a slight hardening of the diaphragm, and the presence of some adhesions in the left costophrenic angle.

The relief from her (pseudo)-pleuritic pains is complete.

METASTATIC OSTEOMYLELITIS OF THE CERVICAL VERTEBRÆ

Dr. Otto C. Pickhardt presented a man, forty-three years of age, who was admitted to Lenox Hill Hospital in August, 1932, for relief of a painful swelling in the neck and behind the right ear. The swelling had been present for four days, and before admission a small incision had been made, but no relief had been obtained. His previous health had been good and there was no history of an otitis media.

The patient had a temperature of 103.6° and looked acutely ill. There was a brawny induration and redness over the right upper neck region extending over the parotid region and behind the ear. The entire area was tender but no fluctuation could be made out. There was a moderate leucocytosis. X-ray examination of the right mastoid region revealed rarefaction over the knee of the sinus, and there was lack of detail in the tip on the right side as compared with the left.

A mastoidectomy was performed on the day of admission. Except for slight congestion of the mastoid bone, the findings were negative.

On the day after admission a blood culture was positive for *Staphylococcus aureus*. The blood-sugar was 250 milligrams. On the following day, the patient's temperature rose to 106.6° and fell to normal within the next twenty-four hours. For the next two weeks the fever varied from 99° to 103.6°. Repeated blood-cultures during this time were still positive. Leucocytosis persisted with only slight variations. For a time the induration in the neck seemed to extend both anteriorly and posteriorly. Thereafter, there was a gradual decrease in both the amount of tenderness and in the extent of the induration. The mastoid wound healed progressively in about the usual time for such a wound. After the first two weeks, repeated blood-sugars were all within normal limits. Albumen, pus-cells, and occasional red blood-cells were repeatedly found during his four months in the hospital. The Wassermann examination was negative.

In the third week of his illness the patient appeared to be doing quite well, and for the first time the blood culture was found to be sterile. At this time he had a chill and eight hours later complained of severe pain in the back of his neck and in the right shoulder region. There were tenderness and a doughy induration over the posterior cervical region. This was four weeks after admission. An X-ray examination revealed a small, pea-sized area of rarefaction with some thinning of the cortex in the anterior and superior angle of the body of the fourth cervical vertebra. It was considered very suspicious of a suppurative focus. After a two-day interval, there was an apparent breaking through of the cortex of the articular surface of the vertebra. In two weeks' time a still larger area of bone destruction in the anterior and superior angle was found. The patient continued to have a fever of 101° to 102.5° during this time, and the essential treatment was confinement to bed in a plaster shell. X-ray examination six weeks after the onset

of the process in the cervical vertebra revealed a much more extensive destruction with a great deal of bony detritus in the joints between the third and fourth vertebræ, and a reëxamination a few days later showed destruction of the inferior articulate surface of the body of the third cervical vertebra with a swelling of the soft part just anterior, suggesting a retropharyngeal abscess. Two weeks later there was very marked involvement in the third cervical body with considerable fragmentation of the bone, and with still greater swelling in the retropharyngeal structures. At this time the retropharyngeal swelling had reached a point where it could easily be felt by the examining finger through the mouth as a hard, indurated, moderately tender mass. The patient was now wearing a reinforced leather collar. This gave a support for his head, and was sufficiently strong so that neither flexion, extension nor rotation of the head and neck was possible. He has worn this to the present time, except lately when in bed.

Röntgen examination in December, 1932, three months after the first X-ray examination, revealed a reparative stage. The detail was much clearer; calcification was taking place; and the bodies of the third and fourth cervicals were regaining their normal contour. The patient was seen at a follow-up clinic several months ago, and his general condition was excellent. The induration in the neck had almost entirely disappeared. X-ray examination at this time did not show any active bone destruction. There was considerable deformity of the fourth cervical vertebra, the body being almost half destroyed. There was, however, no angulation or curvature of the cervical spine. The involved margins of the vertebræ were sharply outlined, indicating excellent healing. X-ray examination during the present month demonstrated osteogenesis, and no active recognizable bone destruction was present.

Dr. Robert H. Kennedy said that reviews of a large series of cases of osteomyelitis showed that lesions of the vertebræ comprised less than 1.5 per cent. of these. The occurrence is probably much more common than the statistics show because of the difficulty in diagnosis. It is more rare in the cervical than in the lumbar or dorsal regions. Moreover, one would not expect this lesion in a man of this age as it usually occurs before the age of twenty. Considering the excellent result in this case, the usual mortality is interesting. It averages 60 per cent. in osteomyelitis of the vertebræ in general and about 30 per cent. in the cervical region, according to the statistics of large groups of cases. It is probable that infection of the bone was present at the time of admission, for one would expect a period of at least two or three weeks to elapse before the X-ray findings would be so definite. Doctor Kennedy said that he did not think he would have refrained from operating because of apprehension lest the pus extend downward behind the pre-vertebral fascia into the mediastinum. The retropharyngeal abscess could have been drained through a lateral incision in the neck. However, the result could not have been better than that shown in this patient.

GUNSHOT WOUND OF CERVICAL SPINE

Dr. John J. Moorhead presented a man sixty years of age who was admitted to the Post Graduate Hospital February 8, 1933. On the day of admission in a hold-up he was shot at very close range with a 38-calibre revolver. The wound of entrance was in the left supraclavicular region one

inch internal to the outer end of the clavicle and about three-fourths inch above it. The left cheek and left side of the neck showed powder marks and there were swelling and ecchymosis on the left side of the neck and considerable swelling of the left upper extremity. He was able to elevate the arm to about half a right angle. There was no apparent neural damage except for a complete loss of sensory distribution on the hand corresponding to the ulnar distribution. The left-sided Horner's syndrome was established by Doctor Sherwood, the neurologist, who saw him in consultation.

The X-ray examination showed the pointed end of the bullet lodged in the interspace between the lateral border of the seventh cervical and first dorsal vertebra and apparently it had entered this space forcibly enough to spread the vertebral bodies apart. Twenty-four hour later, under general anæsthesia, the wound of entrance was débrided; finger palpation located the bullet, a counter opening was made and through this a clamp was introduced as a guide and the entire tract was laid open. Small fragments of bone were removed first and then with a strong clamp the bullet was grasped and removed. Also soft part débris was removed and the tract was lavaged with ether and partly sewed. Vaseline gauze drain and heavy dressings. Convalescence was uneventful except for the development of a very curious pallor and coldness affecting the right hand and the right forearm which developed the day after operation and persisted in diminishing degree for about a week, but was unaccompanied by any motor or sensory loss. There was considerable swelling of the left upper extremity but this gradually decreased and at this time with the aid of physiotherapy it has largely disappeared. The neck motions are free and the involvement of the ulnar nerve is much less.

Dr. Byron Stookey said that since the War no one is amazed at what a bullet may do. In fact, the unexpected may prove to be the expected. In this particular case the fact that the bullet stopped immediately at the intervertebral foramen is of only passing interest. Doctor Moorhead stated that the patient had a paralysis of the ulnar nerve and Horner's syndrome; by that he means an injury to the component roots which make up the ulnar nerve, namely, the eighth cervical and the first thoracic. Watching the patient one would gather that he is unable to extend his wrist and it is probable that the seventh cervical root is injured as well. Exploration of the damage done to the nerve roots by a collar incision would have been advisable had this been possible since early suture of the nerves before scar tissue is formed makes for a better end-result and certainly much simpler operation.

FRACTURE DISLOCATION OF CERVICAL SPINE

Dr. John J. Moorhead presented a seventeen-year-old boy who was admitted to the Staten Island Hospital November 22, 1930, in the service of Doctor Driscoll with a history of having sustained a fracture dislocation of the fifth cervical vertebra on the day of admission in a football game. He was not unconscious; when carried off the field he was unable to use his arms but their function was regained en route to the hospital and on arrival in the institution it was noted that there was free movement of the arms and legs. The first X-rays taken by Doctor MacBrayer disclosed a very extensive fracture dislocation at the fifth cervical level. He was immediately placed in traction

and during the ensuing two days motor and sensory involvement appeared in both arms, being more marked on the right.

On the night of the twenty-fourth an attempt was made to reduce the dislocation manually but this did not succeed and thereafter the repositor was applied under fluorscopical control. It was felt a definite gain had been made and this was verified by subsequent X-rays. However, on the twenty-eighth it was noted that there was apparently a total paralysis of the right arm and both legs and an incomplete paralysis of the left arm so that the forearm could only be flexed weakly. The arms and legs were flaccid and there were no abdominal or cremasteric reflexes. Doctor Masson, the consulting neurologist, stated that the cord condition was very much worse than before the attempts at reduction.

On the twenty-ninth a laminectomy was done with the removal of two spinal processes and it was then seen that the cord was sharply angulated and that there was considerable œdema and that a locking of the articular processes had prevented complete reduction. At the operation no attempt was made to unlock these because the laminectomy apparently provided ample decompression. Five days later improvement was noted in the left upper extremity; there was no power in the legs or in the right upper extremity and pain and temperature was lost on the trunk and thighs and in addition there was a left-sided Horner's syndrome. A plaster-of-Paris neck and body case had been applied and eleven days after laminectomy considerable improvement was noted, particularly of the lower extremity and in the left arm and finger motions were noted on the right hand noted marked improvement.

December 30, three weeks after the operation, there was still further improvement. The worst remaining symptom was an atrophy of the intrinsic muscles of both hands.

He was removed to the Post Graduate Hospital January 6, 1931, and discharged February 24, 1931. The original plaster dressing was removed December 15. Primary union had been obtained and thereafter he wore a metal head and neck support for many months. February 3, 1931, another repositor reduction was attempted but without changing the bony contour, but with rather striking improvement as to the arms. His improvement was continuous and prior to the time of his discharge from the Post Graduate Hospital, namely, three months after the injury, he was able to walk about the ward with considerable ease and had excellent motion of both lower extremities, with little if any sensory involvement therein, and likewise there was considerable improvement of the right upper extremity, but there was still considerable loss of power in the left with some sensory disturbance.

He has been seen at intervals since and at this time, approximately three and one-half years after injury, function is practically normal in all the extremities except for some lessened muscle power in the left upper extremity when unusual use is made of this extremity.

Doctor Stookey said that dislocations of the cervical vertebræ, if seen early, should be reduced early and that as little time as possible should be allowed to elapse before reduction. Of all methods available the method devised by Alfred S. Taylor is by far the best. By use of the Taylor method he has not experienced any great difficulty in reducing cervical dislocations when they have been seen early. On the other hand, when seen late, reduction may be impossible by any method due to contracture and shortening. Reduction by traction with the hands is seldom successful due to the fact that sufficient traction cannot be exerted in this manner. In Taylor's method of re-

duction is used a chin and occiput strap made of moleskin adhesive, the ends of which are tied to a rope which is passed around the hips, the hips being protected by a pillow, or folded blanket. Thus, the trunk musculature can be used and sustained and steady traction exerted, leaving the hands free to guide the vertebræ and manipulate them so as to obtain reduction. Locking of the articular processes can be overcome if adequate traction is applied. In Doctor Stookey's opinion this can be done only by a method which exerts steady, continuous traction and not if the traction is alternately exerted and relaxed. In early cervical dislocations successful reduction will result if this method is followed.

KNEE ARTHROTOMIES

Dr. John J. Moorhead presented a man, March 3, 1928, from whose right knee-joint eight ounces of clear yellow fluid were aspirated, the history being that there had been a progressive painless swelling in that joint without known cause for two years. Examination at that time disclosed evidence of a hypertrophic synovitis without any corroborating signs of semilunar cartilage or of any other joint calculus involvement. X-rays were negative. The fluid recurred and April 9, 1928, through a mediolateral incision, an arthrotomy was done on this knee at which time a moderately complete synovectomy was performed together with the removal of some hypertrophied fat pads and an eroded internal semilunar. The convalescence was uneventful and he had no difficulty with this joint for about a year. On March 7, 1929, an aspiration of the same joint for a recurrence of symptoms yielded approximately fifty cubic centimetres of clear yellow fluid. On both occasions this fluid was negative to culture.

April 8, 1929, another synovectomy was done on this knee-joint through an identical incision and at the same time the external semilunar cartilage was removed because it also was eroded. A pathological examination of the removed material in each instance showed evidence of chronic inflammation. This right knee has remained well to date, namely, for four years.

December 4, 1930, the left knee was operated upon for a condition practically identical with that originally encountered on the opposite side and at this arthrotomy a very extensive synovectomy was performed, together with the removal of excessively large fat pads and an eroded internal semilunar. There was a recurrence of the painless swelling in this left knee after approximately two years and under date of November 17, 1932, another arthrotomy of this left knee was performed and at this time great masses of hypertrophied synovial lining were excised together with the external semilunar. This knee has remained well until about six weeks ago and he now tells me that it is beginning to swell and examination (eight days ago) verifies this, but as can be seen there is not swelling enough to warrant interference.

Here is a case of bilateral hypertrophic synovitis without bone involvement in which, during a period of five years, the right knee has been aspirated twice and two extensive arthrotomies have been performed and the left knee has also undergone a similar sort of exploration minus the aspiration. The notable features are that no known focus has been ascertained although diligent search has been made. The culture of the fluid and the removed synovial lining remained sterile. All serological tests remained negative. These knees demonstrate the reformation of their lining and also demonstrate that the

very extensive removal of intrinsic structures does not interfere with function. These arthrotomies were performed by the technic presented before this society January 27, 1932.

EXPERIMENTAL AND CLINICAL STUDIES OF THE RELATIONSHIP OF THYROID DISEASE AND PANCREATIC FUNCTION

Dr. J. William Hinton read a paper with the above title and presented six patients to illustrate his paper.

Case I.—Female, aged twenty-eight years, was first seen August 27, 1931. Chief complaint was nausea and vomiting, with pain in epigastrium for the past ten years, which was generally worse around 10 or 11 o'clock at night, or when she was unduly tired. In 1920, she was having abdominal discomfort and had X-rays taken in the Boston City Hospital. The X-rays were reported suspicious of an ulcer, although a positive diagnosis was not made. She had had two gastro-intestinal X-ray series done in August of 1931, the first revealing a slight tenderness over the duodenum and suggestive of a filling defect, but repeated studies two days later did not reveal any organic lesions of the stomach or duodenum. There was persistent abdominal pain. Physical examination did not reveal any epigastric tenderness but her skin was dry, pulse 64 and the patient's hair was very thin and she complained of it falling out. Her finger nails were brittle, skin chapped easily and she complained of tiring very easily. She frequently vomited undigested food. A diagnosis of hypothyroidism was made and a basal metabolism done on August 28, 1931, revealed a minus 18. Patient was put on thyroxine one milligram, intravenously, and thyroid extract gr. 1, T. I. D. This was continued at weekly intervals until November 11, 1931, when a basal metabolism was a minus 8, at which time she was still having some abdominal discomfort but greatly improved. She was seen again November 17 and 27, and was not seen again until January 30, 1932. At that time she stated she was feeling very well and only slightly nauseated, her hair was greatly improved, and she was encouraged. Basal metabolism at this time was a plus 3 and she was taking thyroid extract gr. 4, T. I. D., which she had been taking since her last visit in November. Patient was seen about every six weeks from January to July, and on July 22 she was complaining of being tired and having slight abdominal pain, although her weight was ten pounds over what it had been when she was first treated. Basal metabolism repeated on July 27, 1932, was a minus 14. The patient was then seen at weekly intervals and given one milligram of thyroxine, and thyroid extract gr. 6, T. I. D., for a six-week period, and her symptoms entirely disappeared and she has had no complaints referable to her stomach condition since. On January 4, 1933, her basal metabolism was a plus 3, and she had no complaints. The patient was taking thyroid extract gr. 2, B. I. D. When last seen on March 15, 1933, she was feeling very well and symptom-free. This patient has to continue taking thyroid and thyroxine at fairly regular intervals or her basal metabolism will drop and her abdominal symptoms will return.

Case II.—Male, twenty-nine years of age, seen June 4, 1932, complaining of upper abdominal pain which comes on one or two hours before meals and usually is relieved by the intake of food. He had been under the care of several physicians. X-rays revealed a duodenal ulcer, for which he had been treated. Five years previously he had had an appendectomy for chronic appendicitis but following the operation he continued to have the same discomfort as previous to the appendectomy. At the time he consulted me he stated the pain was through the upper portion of the abdomen, radiating directly through to the back, and was more annoying than the abdominal pain. Examination revealed definite tenderness in midepigastrium. A diagnosis of duodenal ulcer had been made, and he was referred to the reporter for operation. Operation was postponed and further medical treatment continued, which was persevered in for five months, but failed to make any satisfactory progress. All previous medication was then discontinued and he was

placed on thyroxine one milligram intravenously, and thyroid extract gr. 1, B. I. D. This was continued at weekly intervals for the next four weeks. October 25, X-rays were negative for a duodenal ulcer. He continued to make weekly visits until December 13, at which time he was practically free from symptoms and was feeling better than at any time since under treatment. He was next seen on December 27, January 24 and March 7 of 1933, and was feeling very well but was continuing thyroid extract grs. 1, B. I. D., by mouth, and had gone from November 1 to March 7 with practically no discomfort whatsoever.

This is the first patient with an ulcer that was given thyroxine and thyroid medication. At a meeting of the New York Surgical Society on October 12, 1932, cases of abdominal pain with hypothyroidism were presented and Doctor Sweet suggested that patients with ulcers be treated with thyroxine and thyroid extract to see what effect it might have, and in view of the fact this patient had been put on treatment only two weeks before the meeting it gave him encouragement to treat a number of other ulcer cases that had not been on other medications.

Case III.—A man, aged thirty-eight years, was admitted to the Gastro-Enterological Clinic of the Fourth Medical and Surgical Divisions of Bellevue Hospital, November 17, 1932, complaining of pain in his abdomen with nausea and vomiting for the past seven or eight years. He had periodicity of pain and at times the pain radiated to his back. During a recent attack he had lost ten pounds in weight and vomited daily. The patient had known for three years that he had a duodenal Ulcer as X-rays taken at that time revealed a positive ulcer. X-rays presented at the time of his first visit, taken October 27, 1932, revealed a persistent defective filling in the inner and outer borders of the duodenum. There was also a defective filling in the pre-pyloric region of the stomach, and a diagnosis of duodenal ulcer was made with no six hour retention. Physical examination was negative and the patient was placed on a fourth-week Sippy diet and given 1 milligram of thyroxine and thyroid extract gr. 1, T. I. D. He was seen at weekly intervals and thyroxine administered. On December 15 the patient stated he had a severe cold but no abdominal pain. Weight at that time was 175 pounds. From that period to the present date the patient has had no abdominal symptoms. He has been seen regularly every week and the thyroxine and thyroid medication continued. Basal metabolism done March 22 was a plus 11. X-rays taken on March 27, 1933 revealed an ulcer of the first portion of the duodenum but no six-hour retention. On March 30, 1933, patient weighed 196 pounds, which was the most he ever weighed, and twenty pounds over what he weighed when he entered the clinic.

Case IV.—Male, thirty-eight years of age, admitted to the Gastro-Enterological Clinic of the Fourth Medical and Surgical Division, Bellevue Hospital, November 17, 1932, complaining of pain in upper abdomen for a period of two to three years, which comes on for a period of a month or two and then gradually subsides, without nausea or vomiting. He never knew what the trouble was until just before entering the clinic when X-rays were taken which revealed an ulcer of the first portion of the duodenum with no six-hour retention. Patient was put on a fourth-week Sippy diet and thyroxine 1 milligram intravenously, and thyroid extract gr. 1, T. I. D. On December 8 his only complaint was constipation but no abdominal pain. Since December 15 he has had no complaints and now is symptom-free. He has been seen weekly and thyroxine administered intravenously, as well as continuing thyroid extract by mouth.

Case V.—Male, aged sixty years, admitted to the Gastro-Enterological Clinic of the Fourth Medical and Surgical Division of Bellevue Hospital on December 15, 1932, stating that five years ago he had gas and pain in the pit of his stomach and one month later he went to the Kings County Hospital where X-rays were taken and he was put on a Sippy diet for two weeks. He was told he had an ulcer of his stomach and advised immediate operation which he refused. He left the hospital and has not been under a doctors' care since but has watched his diet quite carefully and has been practically free from symptoms until six weeks ago when his original discomfort returned and now he has gas and pain in

his stomach. Examination reveals tenderness in epigastrium but no masses felt. X-rays taken December 14, 1932, revealed the presence of an ulcer of the lesser curvature at the pars pyloric and media. The patient was put on a fourth-week Sippy diet, thyroxine 1 milligram, intravenously, and thyroid extract gr. 1, T. I. D. He was seen at weekly intervals and on December 29 he still complained of pain but was taking the thyroxine and thyroid extract. On January 5 he felt very well and had no complaints. Since that time he has been seen weekly, and thyroxine continued, and thyroid extract taken regularly by mouth; he has been symptom-free and was last seen April 6, 1933. X-rays taken February 27, 1933, revealed no organic lesions of the stomach or duodenum. Fluoroscopic examination revealed slight rigidity at the site of the ulcer which is now completely healed. Basal metabolism done February 17, 1933, was a minus 4.

CASE VI.—Female, age thirty-one years, admitted to the Gastro-Enterological Clinic of the Fourth Medical and Surgical Divisions of Bellevue Hospital on November 3, 1932, complaining of having had pain in epigastrium for the past year, with no vomiting but occasional nausea and constipation. X-rays taken October 28, 1932, revealed a pyloroduodenal spasm with 30 per cent. gastric residue at the end of six hours. Patient was placed on thyroxine 1 milligram, intravenously, and thyroid empletes gr. 1, T. I. D. but she did not return to the clinic and a home follow-up on January 30, 1933, revealed the patient continuing to have her abdominal pain and she was very much discouraged. She returned to the clinic on February 3, 1933, and was placed on thyroxine 1 milligram, intravenously, and thyroid extract and has been seen at weekly intervals since that time. On March 9, 1933, she was feeling well, without complaints, and when last seen on April 6, she was symptom-free but continued to take thyroxine and thyroid extract. Her basal metabolism done on March 24 was a plus 12 and her gastro-intestinal X-ray series April 5 revealed a duodenal ulcer, but no six-hour gastric residue.

DR. PAUL C. MORTON (by invitation) pointed out that the relationship of the histological picture to the chemical determinations of iodine in the gland were at variance with the usual and accepted picture. The general conception of this subject is that the iodine in the thyroid gland is in direct proportion to the amount of stainable colloid present. With this in mind, in looking over the sections, it was rather surprising to find that the amount of iodine in the gland did not apparently correlate itself with the amount of stainable colloid along the lines of this premise. A gland with a high iodine content would show very little if any increase in colloid in the sections. It was especially stressed that the observations on the clinical course of these animal experiments seemed to be of more value than the histological picture of the various organs examined.

It is impossible at this time to explain this variance between iodine content and colloid as stated above. On the other hand, in doing these experiments, certain very definite things were noted in the animals.

(1) When the pancreatic duct was tied and sectioned, these dogs developed colloid goitres.

(2) When they were fed potassium iodide with the ducts tied, they died within a very short time.

(3) When these animals were given thyroxin after the duct had been tied, they could be carried along in normal health for a considerable length of time.

It is hoped that this type of clinical observation together with the chemis-

try of tissues will lead to a better understanding of the problem than histological studies.

In all of these animals the adrenal glands were removed at autopsy and histological slides made. Tyrosine is the amino-acid from which both epinephrine and thyroxin are apparently made by the body. This close chemical relationship between these two secretions would make one consider that possibly the adrenal glands might show some disturbance along with the thyroid if the original assumption as presented by Dr. John Staige Davis is correct. Preliminary studies of these adrenal glands would indicate that there are abnormal changes in some of the sections. This will bear further study.

The speaker further emphasized that this work is based upon experimentation involving some sixty-five animals to date, and that this is a new approach to the question of diseases of the thyroid.

Dr. Carnes Weeks said that he thought one of the most important things Doctor Hinton has shown here tonight is the extreme variation in the histological picture of the so-called normal thyroid. As this varied picture is true of the human thyroid so is it true of the dog, and it is easy to see how careful one must be in interpreting the histological findings of experimental work done on the thyroids of dogs. It has been suggested to us that we give all our dogs iodine before any experimental work is done in order that their thyroids may show approximately the same picture. Obviously this would not have been possible in most of the work that Doctor Hinton has reported. In the small number of normal human glands which have been examined for total iodine content there has been as marked a variation as in their histological picture, the figures ranging from 50 to 200 milligrams of iodine per 100 grams of dried gland. The estimation of iodine content in conjunction with a study of the histological picture is being continued in these normal glands in hopes of obtaining some significant relationship.

Dr. Joshua E. Sweet said that thyroid researches had been almost exclusively concerned with the study of iodine. This work has shown that the iodine in the thyroid is in combination with some protein derivative, but very little attention has been paid to this protein factor. The chances are certainly even that the trouble may lie in the protein fraction rather than in the iodine fraction; in fact certain studies have shown that substitution compounds, in which the iodine was replaced by another halogen, such as bromine, exhibit the same action as thyroxin. The whole problem of the thyroid is of interest and filled with inexplicable contradictions. No operation in surgery results in such satisfaction to both patient and surgeon and yet there is no operation so illogical. The authors of this paper are to be congratulated upon their effort to approach the problem by a new route.

Dr. William Barclay Parsons said that in little ways here and there we have amassed information and knowledge about the various glands of internal secretion. Hypo- and hyperthyroidism, hypo- and hyperparathyroid-

ism, hypo- and hyperinsulism are now readily recognized and may be treated with considerable success. The cross-relationship of the various glands is still obscure, and any studies along this line are most worth while. The speaker, however, could not follow Doctor Hinton's logic in reference to the accumulation of colloid in the experimental animals with the pancreatic ducts ligated. It is generally admitted that colloid consists largely of thyroglobulin, an iodine-containing substance in which the iodine occurs either in thyroxine or in diiodotyrosine; and unless the animal has been receiving large amounts of inorganic iodine for several days immediately preceding death, there will not be more than a trace of uncombined iodine in the glands. If tyrosine absorbed from the intestinal tract is the source from which diiodotyrosine or thyroxine is produced, how can the gland increase its colloid content if tying the pancreatic ducts eliminates the possibility of the formation of tyrosine in the intestinal tract?

Doctor Parsons also could not understand the rapid deaths of the animals receiving potassium iodide following tying of the ducts; but the picture produced by the exhibition of tyramine suggests the findings reported by Cole and Womack in animals killed by infection or different chemical poisons. Whether or not some such circumstance has obtained in the animals reported tonight is worthy of thought.

In his paper Doctor Hinton spoke about the poor results in the use of thyroid extract alone in hypothyroid patients, and the necessity for the use of thyroxine in most of these patients. This is expensive and a nuisance to the patients, and very seldom results in a really satisfactory result. This is one of the main points in being somewhat conservative in the amount of tissue left behind after operation, and is why the speaker disagrees with those writers who have the production of hypothyroidism as their object in operating for hyperthyroidism.

Dr. Arthur S. McQuillan noted the fact that Doctor Hinton extirpated one lobe of the thyroid in all the dogs used in this series. This was done for purpose of control of the iodine content of the dog's normal thyroid tissue, and some time before the ligation of the pancreatic ducts. Doctor McQuillan emphasized the fact that extirpation of one lobe of a dog's thyroid gland resulted in the hypertrophy of the remaining lobe and an increase of iodine content up to 30 per cent. The fact has been well established in a series of experiments done by Dr. John Rogers at Cornell in 1921 to show the effect of iodine content of a dog's thyroid gland as a result of adrenal feeding. The increased iodine content was noted in the controls. Doctor McQuillan felt that Doctor Hinton's work should have had this control so as not to include this fact in the results of his work.

Dr. Emil Goetsch pointed out that too much cannot be concluded from the mere appearance of the thyroid gland at any particular moment. Thus, in spite of the fact that the thyroid may contain a large amount of colloid, it may still be functionally rather active and the reverse may also hold. It is

essential that one determine the function of the thyroid cells themselves regardless of the amount of colloid present. He has been interested for a number of years in this problem and has been able to show that the best criterion of cellular activity that we know of at the present is the cellular content of mitochondria. An abundance of these intracellular structures indicates activity. A small part or relative absence indicates inactivity. He asked Doctor Hinton whether the dogs that were submitted to autopsy were sacrificed or whether they had died in the course of the experiment and were then examined. The reason for this question was that the thyroid, being exquisitely sensitive to any changes within the organism, would respond to the profound changes which occur during the latter days of any experiment in which the animal is allowed to die of natural causes. Thus one factor might be that of starvation, for the dogs as is well known will stop eating sometimes for several days before they actually die as a result of the experiment. This starvation alone has a profound effect upon the appearance of the thyroid as was shown some years ago by Jackson of the University of Minnesota.

Doctor Hinton, in closing the discussion, replied to Doctor Parsons that there is considerable debate among investigators as to how the iodine is stored in the thyroid gland. It is maintained by some authorities that iodine is in the form of thyroxine, or a composition that is physiologically equivalent to thyroxine. Others maintain that 50 per cent. of the iodine is in the form of diiodotyrosine. The question of tyrosine and how it works was the basis of this study. If thyroxine is formed from tyrosine, and the protein metabolism is interfered with, and by so doing eliminates the supply of tyrosine to circulate in the thyroid gland, then the iodine content of the gland is increased, due to the fact that the iodine cannot combine with tyrosine to form diiodotyrosine that finally changes to thyroxine, which is the active principle of the gland.

Urinary diastase was not done on these patients but the amylase and lipase of the blood were determined in both dogs and humans. The dogs had their pancreatic ducts ligated, but no increase was found in either of these constituents in the blood. In humans, suffering from ulcers with a history of chronic pancreatitis, it was not possible to determine an increase in either amylase or lipase of the blood. Twenty-five determinations were done on human subjects, and fifteen dogs were used with repeated blood examinations.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD MAY 12, 1933

DR. RODERICK V. GRACE, in the Chair

ANEURISM OF EXTERNAL JUGULAR VEIN

DR. ARTHUR S. MCQUILLAN presented a woman, fifty-three years old, who was admitted to the Misericordia Hospital June 1, 1932, complaining of a swelling in the supraclavicular region. This swelling was first noticed about six years previous as a sequel to taking an anæsthetic for an operation about the mouth. At this time she was given gas-oxygen anæsthesia, and there was considerable difficulty and struggle in going under the anæsthetic. It was during this induction of the anæsthetic that she felt something snap in the right supraclavicular region and for several days after the operation there was a soreness and lameness in this region. About four months later there appeared a swelling in this area which has always been soft and movable and has never given trouble until about three weeks before entering the hospital. At this time the lump became larger, very tense and hard.

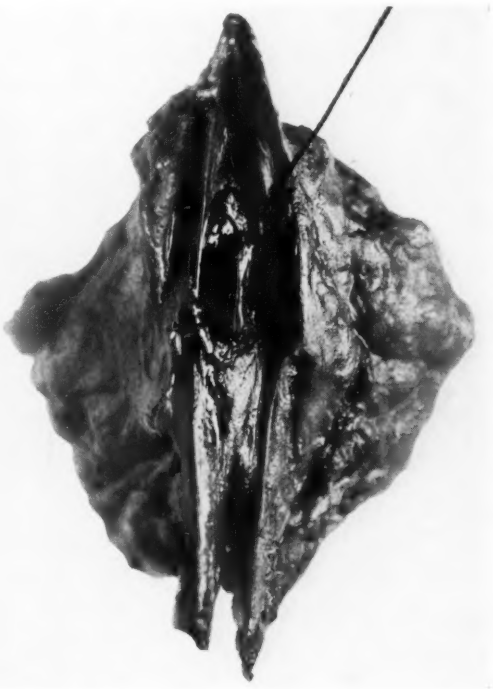

FIG. 1.—Opening from vein into aneurismal sac.

When admitted examination showed a spherical swelling about two inches in diameter in the right supraclavicular region about one inch in diameter above the clavicle in the line of the external jugular vein. To palpation the swelling was tense, indurated and fixed to surrounding structures. There were no pulsations, thrills, or bruit. There were no other nodules found in the cervical region on either side.

At operation this mass was freed from surrounding tissue, the mass being surrounded by a capsule that resembled in color and structure the wall of a vein. Adhesions were thin and newly formed, making enucleation easy. It was found that the external jugular vein above and below led into this mass. For this reason the mass with a section of vein about one inch long above and below it was removed, the proximal and distal ends of the external

jugular being ligated. On opening the vein wall it was found that the mass was connected with the vein by a small opening about one-eighth of an inch in diameter through which opening particles of clotted blood could be squeezed, and making it apparent that this small opening led from the lumen of the vein into a true aneurismal sac. (Fig. 1.)

Dr. John H. Morris stated that he had been unable to find a report of any similar case in the literature. There were one or two points about it to be considered. First, was the term aneurism correct, and, second, if so, did this case fulfill the general conception of an aneurism? It is a fact that one gets the impression from the classification of aneurism that this term should be restricted to arteries. There is, however, no logical reason for this viewpoint since arteries are similar to veins anatomically as well as embryologically. As regards the second point, Keene has defined aneurism as a hollow tumor filled with blood communicating directly with the parent vessel and developed in whole or in part at the expense of its walls. This case evidently fulfills both of these requirements. As regards the classification, many types of aneurisms are mentioned but two only may be considered as pertinent to this case. One is the pathological type of aneurism in which the media is affected by a disease process commonly arteriosclerosis. As a result stretching or rupture of the middle coat follows with the production of the aneurismal pouch. The other type is the traumatic. This may be due to a perforating wound of any type, that is, a direct trauma, and in deference to this case one might take into consideration indirect trauma as the cause where, due to the patient's struggles under general anæsthesia, sudden violent increase in intravenous pressure occurs. Most authorities agree that the essential histological feature common to all true aneurisms is the absence of media from the coverings of the sac. Therefore, the pathogenesis of such aneurisms must be referred to whatever cause is producing a breakdown of the media. One is a toxic or bacterial invasion; syphilis has been given as a cause. Another is the arteriosclerotic process. Still another is mechanical and is produced by sudden increase of intravascular pressure. Experiments have shown that rupture of the media of a normal vessel does not occur from any pressure that could develop under living conditions in man. Where pathological changes have occurred in the media, however, even moderate degrees of pressure are found to be capable of producing stretching or rupture of the middle coat. Therefore, if one assumes that the rupture of this vessel occurred as a result of indirect trauma, there must be assumed some predisposing pathological change in the wall of the vein.

In the study of vascular disease, attention has been largely centered on the arteries, but recently it has been shown that phlebo- or venosclerosis is a relatively common condition which is analogous to similar processes occurring in arteries. Therefore as regards this case it seems permissible to assume, first, that this is a true aneurism of the external jugular vein, and, second, that it was induced by sudden violent increase in intravenous pressure in a vein which was the seat of some neural degenerative process.

PARATHYROID TUMOR

DR. MCQUILLAN presented a woman, forty-six years old, who was admitted to Bellevue Hospital October 28, 1932. Her chief complaint was a swelling on the outer aspect of the neck. Family history was negative as far as goitre was concerned. Present history dated back twelve years when she noted difficulty in swallowing following childbirth. Five years later she noticed in the right side of her neck a swelling which has gradually increased in size to the present time. It has been noticed that this swelling has increased in size during menstrual periods. There is at present no tachycardia, no difficulty in swallowing, no nervousness or tremor. She has taken iodine off and on for the past year. B. M. rate within normal limits. Menstrual history, negative. Has had nine children, seven of whom are living. She was a well-nourished woman. In the region of the right lobe of the thyroid there was a swelling about the size of an orange, somewhat nodular moving with swallowing. A high-pitched bruit could be heard on the upper surface of the neck. No tremors.

Four days following admission this tumor was removed. The whole right lobe of the thyroid was found involved by a degenerated nodular mass. There were many large veins covering the surface of the tumor. The left lobe of the thyroid was found to be normal. The wound healed by primary union and the patient was discharged from the hospital nine days later. The pathological report on section of this tissue was, parathyroid adenoma, composed entirely of oxyphil cells. There was a thin transparent capsule, the underlying tissue having a pink color. There were many prominent veins. On section the surface was smooth and homogeneous with a pink color.

She was later readmitted to the hospital where an X-ray of the bones of the skeleton was found to be normal. Blood calcium determination of 10.2 and blood phosphate determination of 4.2 were within normal limits.

DR. RUSSEL H. PATTERSON stated that Doctor McQuillan's case was a relatively rare one. One of the first cases of hyperparathyroidism reported in this country was that of Dr. Eugene DuBois. The patient had been operated upon twice in Boston and no parathyroid tumor was found. Doctor Patterson operated again on the patient at Bellevue Hospital and no parathyroid tumor was found. After one more operation in Boston another search (the fifth) was again performed and a parathyroid tumor was found in the mediastinum. Doctor McCallum of Baltimore charted the parathyroid glands in sixty-seven autopsied cases. If there were four parathyroid glands in each case Doctor McCallum charted the location of 268 parathyroids; 267 of these parathyroids were located in the usual position, *i.e.*, on the posterior of the thyroid gland. One gland was found to be in the mediastinum. Thus the chances are one in 268 that a parathyroid tumor may lie in the mediastinum. Another interesting point of Doctor DuBois' case was the rapidity in which a fracture would heal. In one instance the patient sustained a fracture of the surgical neck of the left humerus. Solid bony union was present eighteen days after this fracture.

Doctor McQuillan's case was unique in that the patient had a parathyroid tumor without the serum calcium and phosphorus changes and the balance of the clinical syndrome which usually goes with a case of parathyroid tumor.

It is certainly true that decalcification of the skeleton, a negative calcium balance, a high serum calcium and a low serum phosphorus always means a tumor of the parathyroid gland, but, if one may judge by Doctor McQuillan's case, the converse is not true. Doctor Patterson emphasized, in closing his remarks, that there seemed to be no justification for removing the parathyroid glands in Paget's disease or polyarthritis.

Doctor McQuillan rejoined that Da Costa in 1908 reported a case very similar to this one both in regard to blood and bone changes and size of tumor. Turnbull and Hunter in the British Journal of Surgery, October, 1931, reported a series of thirty or forty cases, and Barr (published in the Journal of the American Medical Association about 1920) also reported a series. The tumors in the majority of these cases were all small, on the average of two by four centimetres in diameter. It is only in one or two that the tumor was reported to be as large a one as in the case now presented. There were only a few cases reported which were described as being made up of wholly oxyphil cells or having the majority of cells of the oxyphil type. There were many described as having the majority made up of the chief or principal cells, and, also, some cases were reported where both cells were in abundance. The majority of the cases also showed calcium and phosphorus changes in the blood as well as bone changes, and only a few parathyroid tumors were similar to the one presented showing no blood or bone changes.

VOLVULUS OF THE SMALL INTESTINE DUE TO INCOMPLETE ROTATION IN AN INFANT TWELVE DAYS OLD

Dr. Edward J. Donovan presented a female child, now one and a half years old, who was admitted to the Babies Hospital October 31, 1931, at age of twelve days. Normal delivery at term. Baby has vomited practically everything since birth. Was breast-fed for four days, but the breast was discontinued because of the vomiting. Various formulæ with or without atropine were tried, but the baby always vomited immediately or from one to two hours after each feeding. Vomitus was often bile-stained. It was not projectile, and it contained no blood at any time. Four days before admission she was X-rayed at a private sanitarium where diagnosis of pylorospasm was made. Bowels had moved daily; stools were always constipated and of green color.

Upon admission she was very dehydrated, showed a marked loss of weight, was limp and weak. Physical examination was otherwise negative. She was given an immediate glucose infusion and improved so much by it that in a few hours it was possible to give her a little barium for fluoroscopy. Under the fluoroscope, the barium was seen to pass to the third part of the duodenum, reverse its direction and pass back into the stomach. At the end of five hours, no barium had passed the third part of the duodenum. Weight at time of operation, four and a half pounds. She was operated upon immediately and a volvulus of the entire small intestine from the duodenojejunal junction to the ileocecal junction was found. This intestine was turned in a clockwise direction four complete turns around the superior mesenteric artery and the root of the mesentery as an axis. The intestine

was completely collapsed and blue, but the volvulus was easily reduced by turning it in a counter-clockwise direction four full turns. Color of the intestine improved immediately. No part of the large intestine was involved in this volvulus. The cæcum and appendix lay in the left upper quadrant. The gastrocolic omentum and transverse mesocolon had not fused. The cæcum was brought down to the right lower quadrant and sutured to the posterior parietal peritoneum. Convalescence was uneventful, and it is now one and a half years since operation. The child is entirely free from digestive disturbances and is developing normally.

The condition at fault in this case was that the ascending colon had not come down to the right lower quadrant and fused to the posterior parietal peritoneum, which is the last step in rotation of the intestinal tract after it has returned from the extra-abdominal sac where a great part of its development takes place. The speaker said that he had operated upon two other cases of this condition at the Babies Hospital. They were aged ten and twelve days, respectively. The findings in all three cases were identical, that is, cæcum and ascending colon in the left upper quadrant; failure of the gastrocolic omentum and transverse mesocolon to fuse; failure of the ascending colon to attach itself to the posterior parietal peritoneum in the right lower quadrant of the abdomen.

Dr. Charles E. Farr said that he had operated upon a number of these anomalies with lack of descent and rotation of the cæcum. He had had no case exactly similar to Doctor Donovan's, that is, acute volvulus at the time of operation, but several gave symptoms of partial volvulus and showed some evidence of it at the operation. None was a young infant. The worst case he ever saw was a man of seventy-four years who was operated upon for a carcinoma of the stomach. Here there was complete lack of descent and rotation; the duodenum lay in from of the transverse colon and the jejunum was all tangled up in a mass below the colon and to the left. This man had been perfectly well all his life until the advent of his carcinoma.

Another similar case, in a child one year of age, showed an almost complete obstruction of the jejunum as well as a complete absence of descent and rotation. This child was cured by untangling the bowel and suturing the cæcum and ascending colon in the right iliac fossa. Several similar cases of less degree have also been operated upon successfully.

Doctor Donovan, in closing the discussion, said that he had operated on three babies with volvulus, aged ten, twelve and twelve days, respectively, all with acute obstruction. This child who had vomited since birth probably originally had one turn of the intestine around the superior mesenteric artery for some time, and the remaining turns developed until there was complete obstruction. In all three cases, the findings at operation were identical.

CHOLECYST-GASTROSTOMY IN AN INFANT THREE MONTHS OLD FOR CONGENITAL ABSENCE OF COMMON BILE-DUCT

Dr. Edward J. Donovan presented a female child, aged three months, who was admitted to St. Luke's Hospital, October 4, 1932, with the following history:

Mother first noticed clay-colored stools and dark color of urine when

baby was two weeks of age. Jaundice was first noticed by mother one week later. Clay-colored stools, dark-colored urine and jaundice have always been present since that time. Baby has vomited a great deal since birth, but there has never been any bile in vomitus. She is an only child. Father and mother are alive and well. When admitted she was found to be well developed except congenital club feet. She was well nourished, but definitely jaundiced.

Her liver was large, being three fingers below costal margin. Spleen palpable.

October 20, 1932, the abdomen was opened through a right rectus incision. The liver was found to be very large and of a dark green color, but with a smooth surface. Her gall-bladder was very large and was filled with bile. Exploration of the common duct region disclosed a large structure which appeared to be the common hepatic duct into which cystic duct entered directly. There was nothing visible or palpable in the normal location of the common duct below the junction of cystic with common hepatic duct. By exploration with a needle, bile was obtained from the common hepatic duct and from the gall-bladder. Cholecyst-gastrostomy was done by suture, just proximal to pylorus. Convalescence was uneventful. Sclera and skin were free from jaundice in forty-eight hours. The first stool, forty-eight hours post-operative, was positive for bile. Wound healed by primary union. Bile index, 20, one week post-operative; 10 on discharge from hospital on fourteenth day; seven months post-operative, no jaundice, normal in every way.

DOCTOR DONOVAN said that he had explored about ten such cases, and this is the first one that he had found in which enough of the bile-duct system was functioning to enable an anastomosis to be made to either the stomach or duodenum. In two of these cases, there was no gall-bladder present. In the others, the duct system was otherwise undeveloped. The liver is the first gland of the digestive tract to appear. In a three-millimetre embryo a longitudinal ridge-like projection develops from the ventral side of the foregut just caudal to the stomach, that is, in the portion of the foregut later to become the duodenum. The cephalic part of this evagination is solid and is destined to form the liver proper. The caudal portion is hollow, continuous with the lumen of the gut, and is to form the gall-bladder and the ducts. Both ends of the hepatic evagination become constricted from the gut until its only connection with the gut in an eight-millimetre embryo is a narrow cord of cells, the anlagen of the common duct. The glandular portion of the liver grows very rapidly and is attached to the common duct portion only by the hepatic duct. Both parts of the hepatic evagination grow into the ventral mesentery, that portion involved in the formation of the septum transversum later to form the diaphragm. During the third month, the liver fills most of the abdominal cavity. After the fifth month, it grows more slowly, although at birth it forms about one-eighteenth part of the body weight.

From an embryological standpoint, it is a little difficult to explain the findings in this case. With as careful a search as was possible without jeopardizing the child's chances of withstanding the operation, they could neither see nor feel any structure that had the appearance of a duct below the junction of the common hepatic with the cystic. He added that if these

cases are not operated on before the age of six months it is difficult to get the liver to function.

Dr. Charles E. Farr said he had never been fortunate enough to accomplish anything for these cases as they were all inoperable, either having no external biliary apparatus whatever or an anomaly which would not permit of an anastomosis. According to his study of the literature on the subject about 16 per cent. of these interesting anomalies were amenable to surgery. Most of the successes were in cases where a great cystic dilatation of the ducts was found.

SPLENECTOMY FOR BANTI'S DISEASE. PERFORATED DUODENAL ULCER NINE MONTHS LATER

Dr. Edward J. Donovan presented a man, an Italian, aged fifty-eight, who was admitted to St. Luke's Hospital, April 1, 1929, with a history of having had tarry stools for the previous six days, and a similar attack ten months ago. He showed secondary anæmia, palpable liver and palpable spleen. At exploration, they could find no ulcer of the stomach or duodenum although these structures were not opened. The spleen was considerably enlarged, and adherent to the surrounding structures. It was removed. Pathological report showed chronic interstitial splenitis or what is called Banti's disease. Convalescence was uneventful, and he left the hospital on the eighteenth day. He remained free from symptoms until nine months later, when he was readmitted on account of a perforated duodenal ulcer.

At operation by Doctor Shore a small perforation of an ulcer was found on the anterior wall of the first part of the duodenum. There was no induration about this ulcer so that it was inverted. Convalescence was uneventful. He adhered to no particular diet, but gained weight and did very well until last August, when he was found to be suffering from hyperthyroidism. He was admitted to the medical ward at St. Luke's to be prepared for operation. He left against advice because he had to stay in bed. He has since received five X-ray treatments to his thyroid, and he states that he is very much improved. Since the onset of hyperthyroidism he has lost forty pounds, but he has gained five pounds in the last two weeks. It is now four years after his splenectomy, three and a quarter years after the suture of his ulcer, and he is entirely free from symptoms. Red blood count at the present time, 5,000,000. Hæmoglobin, 98 per cent.

RUPTURE OF THE LONG HEAD OF THE BICEPS

Dr. William Crawford White presented a young man, a flying trapeze performer who is noted for his ability to do the triple somersault in the air. As he finishes this feat he is caught by his brother who is hanging down from a trapeze across the other side of the wide space in the circus tent. The feat is very difficult and, unlike other features of the trapeze performance, it is difficult to time so that his brother seizes him sometimes by the wrist, by the forearm, or even by the elbow. At this moment the arms are hyperabducted and the forearms slightly flexed.

About one year ago, during a performance, when the patient was grasped by his brother, he felt a sudden cramp-like pain in his right arm, and with difficulty he was able to reach his platform. When seen the next morning there was no ecchymosis or swelling, but when he flexed his forearm, the bulge of his biceps was displaced downward and inward as compared to the other

biceps muscle. It was decided that the long head of the biceps muscle had been ruptured. After about two weeks the patient was able to return to full duty, and he continued at his work until thirteen days ago, when he had another accident in the same part of his act. Just as his brother caught him, the right arm was markedly abducted and thrown backward, to be immediately followed by a severe pain at the shoulder-joint and a sense of displacement at the head of the humerus. While his brother was still holding on, he threw himself about and felt a snap at his right shoulder-joint with some relief of pain and return of ability to use his arm again. He has not worked since.

This case illustrates the use an athlete can make of his right arm with the long tendon ruptured, and also a possible late result when hyperabduction and external rotation are used. At present, also, it appears that the infraspinatus and the teres minor may have ruptured at the first accident, for there now is atrophy at these muscle sites. The author was anxious to know if any other treatment than palliative is indicated in a man who must use violent exercise in his occupation.

Dr. Henry H. M. Lyle said that he had never had the opportunity of treating a fresh rupture of the body of the biceps. He had, however, been successful in treating them when the tendinous portion had been ruptured and he had shown such cases before this society. The last one had received his accident while performing on the trapeze and had sheared off the tendon at its insertion to the radius.

Dr. Charles E. Farr said that he had seen several of these ruptures of the biceps muscle or tendon. One in which the long head of the biceps was torn from its origin was operated upon but aside from the cosmetic improvement there did not seem to be any great progress in function. Rupture of the muscle belly could be easily closed but it was doubtful here if the function was ever much better. For an athlete under tremendous strain, such as this man, it was hardly to be expected that closure of the gap would give him sufficient return of power to enable him to perform these dangerous feats.

Doctor White, in closing the discussion, said that he had advised this patient to have an operation after the first accident but it had been refused, on the ground that this had happened to many performers who after a while had been able to carry on their work the same as before.

ANTERIOR GASTROENTEROSTOMY

Dr. Guilford S. Dudley presented a man, forty-two years of age, who was admitted to the Second Surgical Division of Bellevue Hospital with a history of attacks of sharp epigastric pain of eight years' duration. Three weeks prior to admission the pain had become dull and constant and was relieved by vomiting. He had lost seventeen pounds in weight during the past four years. Physical examination was negative. His blood showed 3,000,000 red blood-cells with 70 per cent. of hæmoglobin. Radiographical examination showed no organic lesion of stomach or duodenum, but did show marked stasis in the second portion of the duodenum. Pre-operative diagnosis was duodenal stasis.

At operation, February 15, 1933, an egg-sized retroperitoneal mass was found at the level of the duodenojejunal junction whose consistency was

strongly suggestive of malignant neoplasm. The parietal peritoneum, the liver and the cul-de-sac of Douglas were studded with miliary apparent metastases. There were very many enlarged lymphatic glands within the mesentery of the small intestine. No primary focus within the stomach, large gut or prostate could be detected. The walls of the upper jejunum were thickened and œdematous. This finding was interpreted to be due to interference with the return venous circulation by the mesenteric glands. A gland, removed for biopsy from this region, was reported to reveal chronic inflammation, but no neoplasm. Hence diagnosis remains obscure.

In view of the above findings and of the impracticability of performing posterior gastroenterostomy, an anterior anastomosis between the stomach and distal jejunum was done. No enteroanastomosis was added. Since operation his progress has been favorable. He continues to have moderate pain and some gaseous eructations; but has not vomited and has gained some weight. A post-operative radiographical examination April 24, 1933, shows a functioning anastomosis at the pyloric portion of the stomach with moderate degree of dilatation of the proximal small intestine. It also shows considerable narrowing in the mid-portion of the stomach with intact rugal folds suggesting that this appearance is due to extrinsic causes.

Doctor Dudley presented him, not from the viewpoint of diagnosis or prognosis, but with the thought of introducing the subject of anterior gastroenterostomy. He had performed this operation in the presence of posterior gastrojejunal ulcer; in the presence of neoplastic lesions: during an unfavorable immediate post-operative course following posterior gastroenterostomy and upon other selected occasions—but had never felt that it accomplished as efficient emptying of the stomach as does the posterior operation. This impression has been more or less substantiated by the few follow-up X-ray series that he had seen. Recently he had encountered a large gastrojejunal ulcer at the site of an anterior gastroenterostomy done at another institution. The present case is the only one in which enteroanastomosis has not been included as part of the procedure and its omission does not appear to have influenced unfavorably the outcome.

Dr. John A. McCreery said that he had little enthusiasm for anterior gastroenterostomy, although he had used it in a few cases of extensive pyloric carcinoma in which the posterior operation had been impossible. He had always done an enteroenterostomy in addition, with the exception of a few cases in which he had done a retrocolic anterior gastroenterostomy. He thought that the enteroenterostomy was an important part of the procedure in the case of an antecolic anastomosis. Doctor Dudley was fortunate in that an early secondary enteroenterostomy had not been necessary in this case and thought that it would be advisable to keep the patient under observation as even at this late date gradually increasing angulation might make a secondary operation necessary.

HÆMOLYTIC JAUNDICE

Doctor Dudley presented a woman, aged twenty-eight years, who was treated for the past five years in the out-patient department of Bellevue Hospital for chronic ulceration of the lower thirds of both legs. From the beginning and throughout this period of treatment the continued presence of an anæmia without improvement was recognized. No determination of the cause

of this anæmia was made. In December, 1932, she was referred to the hæmatological clinic of the Second Medical Division where a detailed work-up led to the diagnosis of familial hæmolytic icterus. This was based upon five positive findings: (1) jaundice; (2) increased fragility of the erythrocytes; (3) enlarged spleen; (4) duration of illness (five years); (5) periodic rises in the reticulocyte count.

At the age of five she and a younger sister had attacks of jaundice which, in both instances, resolved themselves completely. This sister now has an anæmia and is being studied for diagnosis. There are five brothers and sisters living and well. During the past year, the patient had become definitely weaker; had noted marked fatigue and had lost a moderate amount of weight.

Examination showed a slight icteric tinge to the conjunctivæ and a firm, enlarged spleen whose free edge was about one inch below the costal margin. The icteric index December 9, 1932, was 35. One month later it was 24. Van den Berg direct delayed; indirect positive. During this month she received iron and copper medication despite which her hæmoglobin dropped from 52 to 38. On December 16, 1932, a fragility test showed initial hæmolysis at .48; a complete hæmolysis at .44. The following morning initial hæmolysis at .48; complete hæmolysis at .42. Blood chemistry was normal; Wassermann reaction, negative. The urine contained no bile pigment but did show a small amount of urobilin. The fæces contained bile. Gastric analysis of the fasting stomach showed free acid of 25 and total acid of 55. After histamine free acid of 27 and total acid of 41. On January 9, 1933, the blood showed 26 per cent. reticulocytes; on February 1, 1933, 11.2 per cent.; and on February 7, 1933, 5.3 per cent. There was achromia porkilocytosis, anisocytosis and microcytosis. The clotting time was one minute, fifty seconds.

She was transferred to the Second Surgical Division and February 8, 1933, her spleen was removed and a specimen of bone-marrow from the sternum obtained. That there might be no disturbance within the bone-marrow, a pre-operative transfusion was not given. Immediately after operation one 500-cc. whole blood transfusion was given. Her gall-bladder was not palpated so that he was unable to state whether or not gall-stones co-exist in this case.

Her post-operative recovery was uninterrupted. The bone-marrow was reported to show normoblastic hyperplastic marrow which is probably due to excessive production of erythrocytes. The pathological report of the spleen was intense congestion. Since leaving the hospital progressive improvement has continued. Her icteric index is now 2; her reticulocyte percentage .2; her red-cell count 5,100,000: and her hæmoglobin 85 per cent. The curves charted on this lantern slide show graphically the changes in the red-cell count: the hæmoglobin percentage and the reticulocyte count. As no change in the fragility of the red blood-cells usually follows splenectomy, this examination has not been done since operation.

Dr. Edward J. Donovan remarked that hæmolytic icterus may be congenital or acquired. The congenital type shows a tendency to occur in more than one member of a family, and early in life. The acquired type occurs in middle life, is more severe and occurs more often in females. Either type shows striking results following splenectomy. Either type may show long remission, but even in the remission there is almost always some evidence of jaundice. The cause of the disease is unknown. Many cases show no change in the fragility of the cells after splenectomy although the jaundice disappears.

This is against the theory that this is a primary disease of the spleen. Sixty per cent. of these cases show pigment gall-stones and have attacks like biliary colic. It is easy to understand why these cases have been operated on for jaundice due to gall-stones.

The speaker had used the left subcostal incision for splenectomy about thirty-five times, and, so far, has had no post-operative hernia. This cuts across the six, seven, eight and nine intercostal nerves, but this apparently does not make the scar weak. The rectus muscle need not be cut, but if its posterior sheath is cut, the muscle may easily be retracted inward. This incision brings one directly on the splenic pedicle and gives an excellent exposure of the spleen.

AN ANALYSIS OF TEN CASES OF HYGROMA CYSTICUM COLLI

Dr. Emil Goetsch read a paper with the above title.

Dr. Edward J. Donovan queried what was the relation of infection to these hygromas. He had seen cases where the tumor increased rapidly in size in the presence of acute infection, such as acute tonsillitis, *etc.*

Dr. Henry H. M. Lyle said his experience was limited to three cases. While he was an interne at St. Mary's Hospital for Children under the late Dr. Charles Dowd they had a case of a very large cervical hygroma extending into the axilla; he himself had demonstrated a similar case about twenty years ago before the Section on Surgery of the Academy of Medicine and ten years ago a case of a small one in the groin before this society.

Dr. Morris K. Smith said that he had hoped the discussion would include types of treatment other than the operative. He had had one of these cases a year ago. Figi, of The Mayo Clinic, reported a series of thirteen cases in twelve of which radium alone was used. Doctor Smith finally decided to operate on his case. It proved to be unilocular instead of the more common multilocular type. Following operation the patient was given a course of X-ray therapy. When last seen, nearly a year after operation, there was no sign of recurrence.

Dr. Henry W. Cave said that in 1923 he had a case of hygroma of the abdomen, which had previously been diagnosed as a mesenteric cyst. The patient was an Italian boy, aged three years, with a markedly protuberant abdomen more pronounced on the right than on the left side. The appearance of the abdomen gave one the impression of a hugely distended mass with a large cystic tumor on the right side. On opening the abdomen no intestines were seen, but a dark, bluish-red membrane containing numerous blood-vessels presented into the wound. Cæcum, appendix, transverse colon were found pushed high up under the liver and spread out over the dome of a great cyst wall. Trocar puncture with suction was applied and about 850 cubic centimetre of dark red fluid drawn off. After opening into the large cyst, two smaller

cysts were found on the inside high up in the mother cyst. About 150–175 cc. of fluid were evacuated from each of these smaller cysts. The mother cyst as well as the daughter cysts were packed carefully with gauze. It was generally agreed that these retroperitoneal hygromas developed from the vestigial lymph-buds. This cyst was, no doubt, a true hygroma of the retroperitoneal space. A follow-up, seven years post-operative, revealed that this child was in excellent condition. Doctor Cave asked if Doctor Goetsch had found any reason for believing there may be an opening between the lymph channels and the blood-vessels. Experiments have shown that there are types of South American monkeys who have a direct connection between the lymph and the blood-vessels.

Dr. Arthur S. McQuillan said that he had one case of a large monolocular cyst which dissected out very easily. He had another case, a girl of twelve years of age, in which the cyst was prolonged beneath the fascia and both sides of the neck. He had not been sure that he got it all out at operation but there had been no recurrence.

Dr. William F. MacFee said, in regard to the treatment of these tumors, he had one case in which the growth was associated intimately with the facial nerve. He exposed part of the mass and discovered it was hopeless to dissect it out without damage to the nerve. He packed the cystic cavities with iodoform gauze which was left in place for a few days and then gradually withdrawn. Eventually there was what appeared to be complete recovery. Does not the fact that the fluid does not coagulate militate as against the theory of lymphatic origin of these tumors.

Dr. Charles E. Farr said that he had worked up for the late Dr. Charles Dowd a review of the literature and an assembling of a list of cases. Since that time he himself had operated upon several cases of hygroma with successful outcomes. One in the submaxillary triangle and one in the groin were very interesting exceptions to the general rule of finding hygroma in the neck or axilla. One very remarkable cervical case in a small infant at St. Mary's Hospital for Children contracted erysipelas during the pre-operative period and was desperately ill. After prolonged treatment with many blood transfusions the child recovered and the hygroma completely disappeared.

Doctor Goetsch, in closing the discussion, referred to the question of infection in hygroma. There was no history of infection in any of his cases associated with the onset of the hygroma. However, in one case in the course of the disease, there was a streptococcal infection which caused rapid growth of the tumor and a severe sepsis. In a review of the literature he had not found any reference to the fact that these hygromatous cysts were the result of infection. They may, however, easily become infected whenever there is an associated tonsillitis or pharyngitis. The late Doctor Dowd pointed out the danger of infection which has frequently caused a fatal outcome.

As to treatment other than operative, mention has been made of spon-

taneous retrogression particularly in cases which have been treated with radium. Doctor Goetsch felt that radium treatment and X-ray are of value in reducing the size of the tumor. The hygromatous tissue, being of lymphatic origin, is very sensitive to radium or X-ray and it might be advisable to give irradiation following operation. Irradiation is particularly of value in the very large tumors in very young children, under a year possibly, for here the operation might be a serious undertaking. In the small, particularly the unilocular tumors, the dissection is easy. In the large, multilocular cases dissection may be very tedious. With reference to the question of the possibility of an opening between the lymph and the blood-vessels, Doctor Goetsch said that he had been looking for this possibility but in no case in his experience was a communication found between the cystic tumor and the venous system even after diligent search with the probe and otherwise. In regard to palliative treatment the use of corrosive substances and even gauze packing might cause a sclerosis and a cure occur in the small tumors but that this method is impractical in the larger, multilocular cystic tumors made up of many cavities which do not communicate with one another. In fact, there are on record cases of spontaneous cure and perhaps also recoveries after infection, all of which indicates that the endothelium of these tumors is sensitive to any irritant and is probably readily destroyed. The difficulty, however, is in reaching all of the many inaccessible cavities. Minor surgical procedures may be and often are dangerous due to the possibility of infection which may result fatally. In some of the cases shown by him iodine was applied to the cavity from which the tumor was removed and there had been no recurrence. The application of iodine may have assisted in the sclerosis and cure. One would expect the fluid to coagulate if it is truly of the nature of lymph but it is probably not a true lymph since it does not coagulate upon cooling and in the uncomplicated cases the content of albumin and globulin is not high. This, however, does not exclude the lymphatic nature of the fluid contained in the cysts.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD OCTOBER 25, 1933

The President, Dr. Allen O. Whipple, in the Chair

THE BEVAN OPERATION FOR UNDESCENDED TESTES

Dr. Thomas H. Russell presented five young men, varying in age from six to twenty-two years, upon all of whom he had operated during the past few months for unilateral or bilateral undescended testes. In all cases he had attempted to employ the Arthur Bevan operation as he had had the privilege of seeing him perform it in the Presbyterian Hospital in Chicago.

The usual hernia incision is employed, that is, an incision beginning at a point mesial to the anterior superior spine of the ilium and continued downward parallel to and over the inguinal canal to a point just below the middle of the external ring. When the external oblique muscle is reached and before it is divided if the testicle is found contained in its sac, at this site as is usual the sac surrounding the testicle is grasped with a hæmostat forcep and dissected free from the surrounding tissue except at its attachment above. The opening in the scrotum is then found and two fingers are introduced into the scrotum, freeing it within. A good-sized gauze pad soaked in saline is then packed into the scrotum, stretching it to its full extent. The external oblique muscle is then divided to the full length of the incision and Poupart's ligament exposed freely on its under side. The sheath of the rectus muscle at its attachment to the pubis is exposed and wiped free. The clamp attached to the sac surrounding the testicle is held up and the cord is dissected free by going through the internal abdominal ring. If a hernial sac is present it is dissected from the cord and divided about midway between the internal ring and testicle. This converts the existing congenital hernia into an acquired hernia, reserving the lowermost part of the sac to act as a tunica vaginalis for the testicle. The peritoneum forming the hernial sac is ligated at the entrance to the internal ring and the excess cut off. The vas and vessels are then dissected from the peritoneum well down through the internal ring until the vas and vessels are long enough to permit the testicle to drop freely into the bottom of the scrotum. This can always be done without dividing the vessels of the cord provided time and patience are given to the procedure. The internal ring is dilated and retracted with several narrow-bladed deep retractors. When the vas is free from the peritoneum it gives suddenly. This is a very delicate and tedious task and requires patience. The vas and vessels of the cord must be long enough to permit the testicle to extend to the bottom of the scrotum. The organ is dropped into the scrotum, then a purse-string suture is taken around the neck of the scrotum leaving the cord behind the suture. This is done to prevent the testicle from accidentally slipping up out of the scrotum. Occasionally, when an unusually short cord is found, it may be helpful to divide the deep epigastric vessels, as they sometimes act as a bar over which the cord has to come up before it begins to descend, thereby shortening it.

The hernia is then repaired in the usual way by suturing Poupart's ligament to the rectus sheath below and to the internal oblique and transversalis muscles above. The cord is not transplanted.

There is always some swelling of the testicle for a while after the operation but if care is taken in handling the organ this is greatly minimized. There may also be considerable ecchymosis of the scrotum if it is stretched too quickly and forcibly.

Doctor Russell was presenting these cases because he thought the results obtained by the Bevan operation, which is usually done in one stage, although he had performed it in two stages, justify its being used more frequently.

The question is frequently asked, "How can one determine before puberty whether an operation is necessary for undescended testicle?" We know that if an operation is necessary the earlier it is done the better the result. Many patients are told not to worry as the testes will descend at the age of puberty. Doctor Russell employed the Bevan test to determine whether an operation is necessary. This test consists of having the boy lie on a table and after the testicle is located if it can be pushed down into the scrotum, even though it does not remain there, it will descend when puberty is reached. If it cannot be pushed into the scrotum after the child is two or three years old, the chances are that it will not descend at puberty, hence, the earlier the operation the better.

Dr. Carl G. Burdick thought these five cases were excellent results from the Bevan operation. In 1926, he had occasion to look up the operations for undescended testicle at the Ruptured and Crippled Hospital; there were over 500, 80 per cent. of which had been followed. The satisfactory results, as far as the location of the testicle was concerned, were about 50 per cent., but only 15 per cent. with normal-sized testes. Since that time he has been doing the Torek operation and has reported 137 cases in which the results were satisfactory. In 90 per cent. the testes were normal in size and located in the bottom of the scrotum.

With the Torek operation one can almost promise that the patient will have a testis well down in the scrotum and normal in size. As far as the Bevan test for determining before puberty whether an operation is necessary, the speaker had never heard it called by that name but always examined very carefully a case diagnosed as undescended testicle, and found that in a fair percentage the testis could be forced down in the scrotum. He did not operate in these cases as he believed they should not be classified as undescended. He felt that the Torek was the operation of choice.

Dr. Edward W. Peterson said that when two plans of treatment were under consideration that the only fair test was a trial of both methods. He had operated upon cases of undescended testicle by both the Torek and the Bevan methods. In his own experience he felt that any case that gave promise of a good result by the Torek operation could be assured of an equally good result by the Bevan technic, without the necessity for the second-stage operation. In his clinic, for the past six or eight years, thyroid and anterior pituitary extracts had been used, and he thought with benefit, in the cases that were being prepared for operation.

DR. FRANZ TOREK said that the results in the three adults among these five cases were better than any he had ever seen in which orchiopexy was not done. Two of them were very good. The third case has a testis half way down but it is atrophied or it has not developed, which brought up the point as to why the speaker attached the testis to the thigh; it was not only to secure the proper degree of descent but also to give it a chance to get nourishment from a new source. He never made an artificial tunica vaginalis; he considered that to be objectionable because it interposed a tissue between the testicle and its new source of nutrition. In the two children presented the testicles are too high up, being placed about at the neck of the scrotum. They may possibly come down farther later, but it is not a satisfactory immediate result. It is well known that, even many years ago, there have been successful operative results in cases of unilateral nondescent, but only in favorable cases, namely, where the undescended testicle was of fairly good size and where a reasonable amount of scrotum was present. The question why the Bevan operation is so called has been a mystery to many. In 1899 Bevan described the separation of the cord from the vaginal process of the peritoneum, dividing the vaginal process transversely, dissecting its proximal end up to the internal inguinal ring and bringing the lower end down. This same procedure was described in Dennis' Surgery four years earlier in an article by William White who furthermore calls attention to the necessity of separating each and every adhesion to the cord. White laid no claim to originality but described it as though it had been the acknowledged method of procedure. And that appears to have been the case, for in 1880 Schüller described the same method, and likewise Nicoladoni in 1885, who went somewhat more into details. In the literature it was occasionally spoken of as the Schüller-Nicoladoni operation. As a matter of fact, after Bevan's first publication the operation was not spoken of as Bevan's. Only after his second article, four years later, in which he prefaced his description by stating that he had made some improvements which placed the operation in a position where it should be accepted as a standard procedure, did the profession take notice, for in this article Bevan said something that had not occurred to any one before, namely, that in some cases he divided the spermatic vessels. But as in other respects the method remained the same as that described by White, the profession, taking the hint that here was a standard procedure, called the division of the spermatic vessels the Bevan operation, as that was the only original part of the procedure. In 1929, Bevan stated that he had not divided those vessels in four or five years, so, after this step had been eliminated, Doctor Torek was unable to see what there was left of the Bevan operation. Nevertheless Bevan should be given full credit for having helped to awaken the interest of surgeons in the operative repair of undescended testis.

DR. WILLIAM B. COLEY stated that the method of operating upon the undescended testis evolved at the Hospital for Ruptured and Crippled be-

tween 1893 and 1899 by Dr. William T. Bull and himself, was practically similar to the method described by Bevan, first in the J.A.M.A., September, 1899, and later in the J.A.M.A., September, 1903. Doctor Coley's first operation was performed in 1893; he divided the sac and sutured the lower end over the testes; he then dissected the cord as free as possible up to or beyond the internal ring. The testis was placed in the scrotum. In this case and in several others he closed the canal by the Bassini method. Doctor Bull, however, in 1893, in operating on another case, saw that by omitting the transplantation step of the Bassini operation, there was gained one-half inch or more in the length of the cord. This is one of the important steps noted by Bevan in his operation. Up to 1899, Doctors Bull, Walker and Coley had performed twenty-six operations for the undescended testis. They had given up transplanting the cord, and relied chiefly on a thorough freeing of the cord, cutting the fascial bands but not the vessels of the cord. While many of these cases were reported in their papers on the Radical Cure of Hernia published prior to 1899, they gave no special detailed account of the different steps of the operation. Bevan, in 1899, was the first to do this; hence the method has been designated, and, in the opinion of Doctor Coley, very properly, the Bevan method.

Doctor Coley believes the method has given by far the best results of any operation except the Torek; he still believes there is a large number of cases which can be treated just as successfully by the Bevan method as by the more complicated two-stage method of Torek. He agrees with Doctor Burdick that the Torek method gives a higher percentage of ideal results than does any other, but he believes it should be reserved for the more difficult cases in which it is not possible to bring the testis down to the bottom of the scrotum without tension.

Doctor Coley stated that as early as 1903 he advised against operating upon very young children, as advocated by Broca of France and also by Bevan. He still believes that it is unwise to operate on the undescended testis in children under ten years of age, except in cases with hernia difficult to control, for the reason that in many cases as the boy approaches puberty the testis descends into the scrotum spontaneously. Doctor Coley does not believe it is possible to determine beforehand by any such simple method as described by Doctor Russell, in just which cases it will descend, and in which it will not.

EMBOLECTOMY OF COMMON FEMORAL AND EXTERNAL ILIAC ARTERIES

Dr. DeWitt Stetten presented a woman, aged fifty-eight years, who had been on the medical service of Dr. Otto M. Schwerdtfeger at the Lenox Hill Hospital from January 31 to March 14, 1933, under treatment for cardiac hypertrophy, with arhythmia and auricular fibrillation, due to a mitral stenosis and insufficiency. She was re-admitted to the hospital April 22, 1933, because of dyspnœa, orthopnœa, and weakness of the right upper and lower extremities, and slight difficulty of speech, which had developed about eight hours previously. These last symptoms were ap-

parently due to a small embolism of the terminal branches of the left middle cerebral artery. Examination showed weakness of the right upper and lower extremities, with hyperactive reflexes on both sides and a Babinski, right. There was also a slight flatness of the right side of the face. Under the usual treatment the patient improved, but on April 25, 1933, some time around noon, she complained of sudden pain in and complete inability to move the right leg, foot and toes. During the afternoon when seen by Doctor Stetten her right lower extremity from the mid-thigh down was cold to the touch, pale and slightly mottled and bluish, almost cadaveric in appearance. She was unable to move that extremity. There were no reflexes and there was definite, though not complete, anæsthesia to pain, touch and temperature of the entire leg and foot. No femoral, popliteal, dorsalis pedis or posterior tibial pulse could be felt. The left leg was warm, normally pinkish in appearance, the reflexes were active, the sensations were relatively normal, and the femoral and dorsalis pedis pulse were strong, but the popliteal and posterior tibial pulse could not be felt. On the inner side of both feet and ankles and on the inner side of the left calf were some small superficial varices. Oscillometer readings with blood-pressure at 120 on the left thigh and calf were practically normal, 5 and 3 respectively; on the right side there were absolutely no oscillations of the needle from the knee down, and the very slightest movement in the mid-thigh. The temperature was 101.4°; the pulse, 80, and irregular; the blood-pressure, 118/80. The heart showed the characteristic signs of hypertrophy with the typical murmurs of a double mitral lesion. It was fairly well compensated. A diagnosis of an embolus of the right common femoral, probably extending up as high as the external iliac, was made. The chances were against a riding embolus of the common iliac, because of the completely normal condition of the left lower extremity, and it was decided to attempt to extract the embolus.

About seven hours after the initial symptom, the operation was performed under local anæsthesia. An oblique incision was made in the upper thigh, and the femoral artery was exposed in Scarpa's triangle from Poupart's ligament downward for about four inches. It appeared to be a relatively small vessel. There was no visible nor palpable pulsation. With tapes above and below for traction and hemostasis, a longitudinal incision was made through all the coats of the artery and a long, thin, soft, dark-red thrombus about three centimetres in length was exposed and removed. It was not adherent. The vessel did not appear to be particularly atheromatous and the intima was smooth. On removal of the thrombus, there was a free flow of blood from the distal portion of the artery, but as yet no free flow from the proximal portion, indicating still further occlusion above. An attempt was made to remove the remaining piece of the thrombus with a forceps, but without success. The proximal portion of the vessel was then irrigated with normal saline solution and a piece of the thrombus, nearly two centimetres in length and considerably thicker than but of the same character as the other thrombus removed, was ejected from what was apparently the external iliac artery under Poupart's ligament. (Fig. 1.) This was followed by a free flow of arterial blood. A large probe was then introduced into the vessel for about ten inches in an attempt to dislodge any remaining thrombus, and none could be found. The arterial wound was sutured with a paraffin-oiled continuous silk suture. Although, after the closure of the artery, there did not appear to be a true expansile pulsation at the site of suture, there was a distinct propulsive pulsation of the vessel immediately above the suture line, which had not been present before,

indicating at least that the patency of the lumen had been extended upwards. It was felt that, even if a complete re-establishment of the arterial blood-stream through the normal original channels had not been accomplished, at least sufficient of the thrombus had been extracted to permit of fairly satisfactory collateral circulation through previously occluded anastomotic branches. A further search, therefore, for any remaining thrombus seemed unnecessary, and the skin was sutured. The leg was wrapped in absorbent cotton and placed under an electric light cradle.

Immediately following the operation, the circulation of the affected extremity seemed decidedly improved. There was less pain, the leg and foot became warm, and the cyanotic pallor changed to a pinkish hue. Sensation also improved and toe motion promptly returned. The right femoral pulse could always be felt very definitely after the operation, and on May 1, 1933, a very faint dorsalis pedis pulse also seemed to be present. The patient's temperature gradually dropped and reached normal four days after operation, where it remained. The wound healed by primary union. The extremity gradually became quite normal, the pain almost entirely disappeared and the patient was allowed up June 5, 1933, at which time the

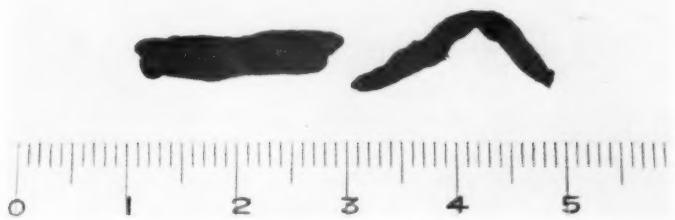

FIG. 1.—Embolus removed from common femoral and external iliac arteries.

oscillometer needle showed a slight response in the right leg and quite a definite one in the right thigh. The patient was discharged from the hospital July 13, 1933, and since then has apparently been fairly well. She is able to get around quite satisfactorily, although she drags her right leg somewhat, undoubtedly because of the weakness following her mild hemiplegic attack prior to the embolic occlusion. She has at times some pain in the right great toe, especially when she has been up on her feet for a longer period of time. Examination shows the right lower extremity in feel and appearance very much like the left—warm and quite normal in color. The patellar reflexes on both sides are active. There is a Babinski, right. All sensations are quite normal and acute on both sides. There is still a strong left femoral and dorsalis pedis pulse, but the popliteal and posterior tibial cannot be felt. On the right side there is a good femoral pulse, but it is somewhat weaker than on the left. No popliteal, dorsalis pedis nor posterior tibial pulse can be felt on the right side. At present the oscillometer readings with blood-pressure at 115 are: right thigh, 3; right leg, 1½; left thigh, 7; left leg, 2½.

Doctor Stetten added that much had been written in recent years on the subject of peripheral embolectomy and a fair proportion of the cases reported had been very successful. The speaker had attempted it on a number of occasions, but this was the first time that he is able to report a rescued limb. All the other cases of circulatory obstruction of an extremity

due to embolism in the main artery, which he has observed have resulted in a loss of limb or life, and generally of both—either with or without embolectomy. It may be that in this case, as has been indicated, the operative procedure did not directly completely restore the normal arterial circulation at the time of operation, but it is quite certain that it did effect an immediate and definite improvement in the circulation—probably by establishing a collateral flow either through the deep femoral or the anastomotic branches from the internal iliac, the orifices of which may have been blocked by the thrombus. Whether the ideal anatomical restitution of the circulation has been made by the operation or not is really not of vital importance as long as the practical physiological result of maintaining the nutrition of the limb is obtained, even if this is done by indirect means through collateral vessels. At any rate, the situation calling for this surgical intervention is usually so desperate, the operation itself is such a very simple, minor procedure and can so readily be done under local anæsthesia without the slightest risk, even in critically ill patients, that the attempt is certainly justifiable in suitably selected cases, and nothing is lost should it fail.

Dr. Harold Neuhof said that Doctor Stetten's case was an excellent illustration of the fact that restoration of the parts could occur without return of through circulation. The ideal objective was, of course, the restoration of normal circulation after embolectomy. In the literature are a number of satisfactory clinical results and yet the return of through circulation at the site of the embolus has not been proven to have occurred in any of the reported cases, or, at the most, in one or two. However, the results that have been obtained cannot be conceived of as in the nature of an accident any more than one could picture the result in Doctor Stetten's case as an accident. It is fair to assume that his case would have gone on to progressive gangrene if embolectomy had not been employed. What then had been gained by operation in his case since at least partial occlusion at the site of embolectomy followed? It was Doctor Neuhof's opinion that the result was obtained because the removal of the embolus permitted circulation through collateral branches. It also permitted at least some blood flow through the trunk of the vessel. It was at least an open question if one should attempt the Carrel technic without being familiar with its niceties. There are inherent dangers in the application of that technic when one is dealing with a diseased vessel wall or a vessel wall altered as a result of the lodgment of the embolus. With Carrel technic and the effort at a perfect restitution of circulation, appreciable thrombi may form at the site of suture in an altered vessel wall, to be carried down and lodged at a lower point in the extremity. The increasing danger of gangrene with lower lodgment of emboli is of course well known.

The difference between results of ideal embolectomy and arterial obliteration is well exemplified by two cases shown some years ago by Doctor Neuhof. One was the rare instance in which an embolus was removed from a popliteal artery shortly after its lodgment and through circulation occurred and persisted. This patient had a useful extremity but suffered recurring attacks of claudication and other evidences of interference with circulation.

These were presumably due to scar tissue at the site of the arteriotomy and suture. In the other case an obliterative endo-aneurismorrhaphy of the popliteal artery had been performed. There were no untoward manifestations and the patient could walk miles without symptoms.

In the last case on which the speaker carried out an embolectomy he proceeded on the assumption that the essential objects were to remove the embolus, permit passage of blood through the branch of the artery above which the embolus was lodged, and to narrow the lumen of the incised artery so that large thrombi would not be carried down into the extremity. The result in this patient, an old man with an embolus lodged at the junction of the axillary and brachial artery, was excellent, despite the fact that there was no appreciable through circulation at the site of arteriotomy and suture. It was important to bear in mind that limbs have been retained in instances in which embolectomy has been advocated and operation refused. This has been particularly the case with embolic block at high levels in extremities. Specifically, he has seen instances of blockage at the bifurcation of the abdominal aorta in which bilateral gangrene of the extremities appeared impending if nothing were done and yet there was full or almost full recovery without operative intervention. He believes that operation should not be advocated for the riding embolus of the abdominal aorta and should not be advised in all cases of arterial blockage in the extremity itself. It is well to observe the case for a few hours in order to try to come to some conclusion as to whether embolectomy should or should not be performed. This viewpoint almost automatically excludes the idea of embolectomy as an operation to be performed at the earliest possible moment after a prompt diagnosis has been made.

Doctor Stetten, in closing the discussion, said he thought Doctor Neuhof had given the impression that peripheral embolectomy is a difficult and dangerous procedure, but it is really very simple and quite without risk. With a little practice on the animal and the cadaver anyone can become quite expert in the Carrel technic of arterial suture, especially on an artery the size of the common femoral. In the speaker's opinion the operation is thoroughly justifiable in suitable cases. He is convinced that in this case there was no accidental recovery and that the patient's limb would never have survived without the operation. It really makes very little difference if the result is not perfect anatomically so long as the limb has been saved.

ANAL SPHINCTEROPLASTY FOR TOTAL INCONTINENCE

Doctor Stetten presented a woman, aged thirty-eight years, who was admitted to the Beth Israel Hospital November 4, 1932, with a history of having been operated on elsewhere February 29, 1932, for what was apparently a large perirectal abscess to the right of the anus. Immediately after the operation the patient became totally incontinent of fæces and had since regained no control whatsoever. Rectal examination showed a wide, gaping, anal orifice, with marked scarring on the right side and absence of rugæ. The rugæ on the left side were still present. (Fig. 2.) There

was a tendency toward prolapse of the anal mucosa. Digital examination elicited no sign of sphincteric action. When the patient was requested to make a voluntary effort to close her anus, the left half of the sphincter merely shortened and thickened in the attempt. It was obvious that much

FIG. 2.—Total incontinence of rectum due to destruction and cicatrization of right half and retraction of left half of sphincter ani following infection and operation.

FIG. 3.—Crescentic incision on diseased side.

FIG. 4.—Exposure of ends of remainder of external and internal sphincters. Two mattress sutures placed through ends of remainder of external sphincter.

FIG. 5.—Two mattress sutures of external sphincter and three sutures of internal sphincter tied.

of the entire right half of both the external and internal sphincters for an arc of 180° had been destroyed by the infection and previous operation, and that the left half had retracted but was still more or less preserved.

It was felt that an attempt at repair was warranted, especially as the operation was without risk and there was nothing to lose should it fail. Accordingly, after a most careful pre-operative preparation, including several days of very thorough catharsis, colonic irrigation, and fluid diet, she was operated on under spinal anæsthesia November 17, 1932. A crescentic incision was made over the scar to the right of the anus (Fig. 3), and, anteriorly and posteriorly, the ends of the remaining left half of the sphincter were quite definitely exposed and readily recognized, lying almost in the median line. The dissection was extended upward somewhat and fibres of what was apparently the internal sphincter quite widely separated were also exposed. (Fig. 4.) A No. 22 F. soft rubber catheter was placed in the anus

FIG. 6.—Skin sutured and anus restored.

and the two ends of the remaining left half of the sphincter were easily brought together so as to complete the circle with two chromicized catgut mattress sutures. The separated fibres of the internal sphincter were also approximated with three simple interrupted chromicized catgut sutures. (Fig. 5.) The skin incision was then closed completely without drainage with interrupted chromicized catgut sutures. (Fig. 6.) A small dressed rectal tube was left in the anus.

For eight days the patient was kept on a fluid diet and constipated, and then a small olive-oil retention enema was given through the rectal tube, followed by a colonic irrigation. This was given daily with milk of magnesia, two drams t.i.d. Ten days after operation the patient had a relatively normal, soft bowel movement, over which she had good control. Aside from a small fistulous opening, which developed in one of the an-

terior skin stitch holes, which closed spontaneously within two months, the wound healed by primary union with apparent union of the sphincter suture lines. Except when she has very loose bowel movements from a dietary indiscretion or from taking a cathartic, she has practically perfect control, and can now again lead a normal life. She has gained fourteen pounds in weight since her operation. She is taking regular active sphincteric exercises twice daily, which have further improved her control even over her loose movements. Examination at the present time shows a tightly closed anal orifice, plainly re-formed rugæ on the right side, and definite sphincteric action when the patient voluntarily closes her anus, which can be verified by visual inspection and digital examination. The speaker said that the essential factors in the success of this type of operation are the very thorough pre-operative preparation with fluid diet and complete emptying of the intestine, the protracted post-operative constipation also with fluid diet, and the very careful primary moving of the bowels thereafter.

INOPERABLE LYMPHOSARCOMA OF THE CHEST CONTROLLED FOR FOUR YEARS BY COLEY'S MIXED TOXINS AND IRRADIATION

Doctor Stetten presented a man, aged sixty-two years, who first came under his observation November 25, 1929, complaining of an uncomfortable feeling in the lower portion of the right side of the back, radiating downwards and across the lower spine. This symptom had begun about a year previously, and about six months later he first noticed a soft growth in this region, which had been gradually increasing in size. On the right side of the back, just lateral to the spine and running from the sixth to the tenth ribs, was a large, protruding, hemispherical, smooth, soft, semifluctuating, insensitive tumor adherent to the chest-wall, and apparently lying beneath the back muscles. It protruded about three inches from the chest. Percussion over the right lower chest was flat, and voice and breath sounds were absent. There were no enlarged lymph-glands. The blood count showed a slight secondary anæmia, but was otherwise relatively normal. The weight was 145 pounds. X-ray examination revealed a dense shadow filling the lower half of the right chest, probably due to solid tissue. There was no evidence of any bone invasion, either in the ribs or vertebræ.

November 30, 1929, under local anæsthesia, the mass was aspirated, but the needle evidently entered solid tissue as no fluid could be withdrawn. A probatory incision was then made, and a soft, pinkish, friable, homogeneous tumor was entered, lying beneath the muscle layer of the back. A specimen was excised for microscopical examination. The pathological report by Dr. F. D. Bullock was atypical lymphosarcoma, largely of the lymphocytoma type. The structures consisted, for the most part, of a diffuse growth of lymphoid cells, many of which showed mitotic figures. In a number of places, there was a formation of follicles with germ centres, the cells of which were actively proliferating. The stroma was generally very scanty, although in places the tumor was penetrated by thick, fibrous or hyaline trabeculæ. The muscles of the back were extensively infiltrated by the growth. It was obvious that any radical operative interference was out of the question. The patient was immediately put on deep X-ray therapy over the lesion and started with a course of injections of Coley's mixed toxins. He was peculiarly resistant to the mixed toxin injections, which were given intramuscularly, and also into the tumor, and not until he had had eight minims injected did he show any decided reaction. Under the combined X-ray and mixed toxin treatment, the external tumor rapidly diminished

in size, literally shrinking visibly from day to day, so that by December 25, 1929, it had completely disappeared. With its disappearance the flatness and absent voice and breathing over the lower right chest also diminished. The injections of mixed toxins were discontinued January 16, 1930, but intensive irradiation over the right back and chest was continued at frequent intervals. During the treatment the patient's weight dropped to as low as 133 pounds, but with the disappearance of the tumor, the clearing up of the chest, and the discontinuance of the mixed toxins, he began to regain his weight. On February 21, 1930, X-ray examination showed that the pathology in the right lower chest had completely disappeared.

In May, 1931, the patient complained of severe pains in the back with pressure in the right upper abdomen. He did not look well, but there was no evidence of recurrence either on routine examination or by a very thorough X-ray investigation. He was relieved by another series of X-ray treatments over the right and left lumbar and liver regions. On March 12, 1932, although there was no external evidence of tumor recurrence, an X-ray examination showed some flattening and elevation of the right vault of the diaphragm, and what was apparently a pleuritic effusion in the left chest. He was somewhat improved by another course of irradiation of both chests, but again had a setback in April, when he complained of shortness of breath and a slight cough. Another course of X-ray therapy over both lower chests afforded marked relief. X-ray examination on September 13, 1932, showed comparatively normal conditions, except that there was some thickening of the pleural shadow and pulmonary markings in the right superior mediastinum, and rather heavy right lung root shadows. About this time he presented himself with a smooth, freely movable, enlarged, cervical lymph-gland, about the size of a hazelnut, in the left supraclavicular region. September 27, 1932, this was excised under local anæsthesia. It was found to be an encapsulated growth, obviously an enlarged lymph-gland. On section it was pinkish, soft, friable and granular, and had the gross characteristics of neoplastic involvement. Microscopical examination showed a lymph-node largely replaced by a tumor composed of compact masses of round and rather granular cells containing round vesicular nuclei, many of which were in some stage of mitotic division. The cells grew diffusely or in large and small masses, which were supported by lymphoid tissue. This tumor differed from the original tumor in that the former was composed of cells of the lymphocytic type, while the present tumor was derived from reticulum cells, and had to be regarded as a reticulum-cell sarcoma of a cervical lymph-node. X-ray treatment was then given to the left supraclavicular region. Again in March, 1933, the patient noticed similar glandular swellings in both the left and right submaxillary regions. The one on the left side was about the size of a small egg, and on the right side the size of a hazelnut. Both were firmly attached to the deeper parts. They were not removed and under X-ray therapy these nodules also completely disappeared in about five weeks.

In the beginning of May, 1933, the patient complained of pain and swelling of both wrists, especially the right. The right wrist was markedly swollen and tender, and the left moderately so. As he had a temperature of 101°, it was suspected that this might be an intercurrent rheumatic arthritis, but, when it did not subside under the routine antirheumatic treatment, an X-ray examination of both wrists was made. It showed several small, well-defined areas of rarefaction in the lower end of the right radius, and a suspicious area of a similar character in the left navicular. On the theory that these were bone metastases, a thorough course of X-ray therapy

to both wrists was begun with prompt recession of the swelling and symptoms. At about the same time another glandular nodule the size of a hazelnut developed in the right supraclavicular region, which again completely disappeared in about a month under X-ray therapy. At the present time the patient is quite free from any evidence of disease, except that the wrists are still slightly thickened, especially the right. On X-ray examination, his chest is quite as normal as it was a year ago. He weighs 160 pounds, which is his maximum weight, and is twenty-seven pounds above his lowest weight in the early part of his illness. Although he is a trifle pale, his general health appears to be very good. Except in the beginning of his illness, when he was receiving the mixed toxins, and for short periods of a few days each, when he was temporarily disabled, he has worked quite steadily at his job as bookkeeper.

It is well known that this type of tumor is peculiarly radiosensitive, at least for a time, but it is also generally conceded that the possibility of an ultimate cure is very doubtful. As a rule, after a year or two, response to irradiation decreases, and eventually is lost entirely, and the patient generally succumbs to recurrences or metastases. The length of time that this case has been kept under control warrants its presentation. Although it is by no means suggested that the patient is cured, at least the disease has been kept in check for four years by massive X-ray dosage, which has been unusually well tolerated. One interesting feature is the apparent difference in the pathological character of the cervical lymph-gland lesion as compared with the primary growth. The question might be discussed whether these two lesions are independent growths or whether the lymph-gland disease is simply a metastasis with metaplasia owing to its location. One fact is quite clear—namely, that the lymph-gland lesion responded just as readily to the X-ray therapy as did the primary tumor.

Dr. William B. Coley called attention to the case of intrathoracic tumor presented to the New York Surgical Society by Dr. Howard Lilienthal January 12, 1927, which, he believed, in some respects simulated the case presented by Doctor Stetten. He showed two lantern slides of this case: (1) a large intrathoracic tumor before treatment; and (2) one taken seven years later, showing a normal chest. This patient, a female aged four years, came under Doctor Lilienthal's care on April 12, 1924, with a history of having had an intrathoracic tumor for nearly a year, progressively increasing in size until March 16, 1924, when the patient had developed paraplegia. Röntgenological examination showed a large mass in the right chest extending across the median line into the left chest above the heart. The opacity of the right side occupied the lower two-thirds of the chest and extended to the left above the heart where was a large shadow. There appeared to be partial erosion of the adjacent ribs posteriorly and also some erosion of the bodies of the neighboring vertebræ. There was a protruding subcutaneous mass covered with normal skin between the right scapula and the spine. Doctor Lilienthal performed a posterior thoracotomy, removing a portion of the tumor about the size of a golf ball. On microscopical examinaion, this was pronounced a highly malignant tumor. The specimen was later examined by Doctor Gross, who regarded it as a "hemangio-endothelioma," and by Doctor Ewing, whose opinion was "malignant cellular tumor of

embryonal type composed of many blood sinuses lined by two or more rows of tumor-cells. Very delicate stroma." In the opinion of the latter it was an extremely malignant type of tumor.

This patient was treated with toxins alone (mixed toxins of erysipelas and bacillus prodigiosus). She proved very susceptible, her temperature on one occasion rising to 108° F. In Doctor Coley's opinion the remarkable feature of this case was that under only eleven injections all evidence of the disease disappeared, and the patient was in excellent health when presented by Doctor Lilienthal three years later. She was still well when presented by Doctor Coley at the Memorial Hospital conference December, 1932, and is still well.

Doctor Coley said, that the first case that had aroused his interest in the effect of erysipelas upon malignant tumors was one of recurrent lymphosarcoma of the neck in which Dr. William T. Bull, after attempting a fourth operation in 1884, found the disease had so extensively involved the deeper structures of the neck that he abandoned the operation, closed the wound, and regarded the condition as hopeless. The patient developed a severe attack of erysipelas in the wound immediately after the operation, and ten days later a second attack occurred. On coming across the history of this patient in 1890, while making a study of all the cases of sarcoma observed at the New York Hospital over a period of fifteen years Doctor Coley was so impressed with the remarkable result that he made an effort to learn how long the patient had survived. He finally was able to trace the latter, and found him in excellent health, without any trace of the tumor, six years later.

This result led Doctor Coley to try the effect of the living streptococcus of erysipelas on a group of inoperable tumors. The first case which he inoculated in 1891 was one of far-advanced inoperable sarcoma of the tonsil and neck; the patient made a good recovery and remained well for eight years when he had a recurrence which proved fatal. Since then Doctor Coley has had an opportunity of using the toxins in a large number of cases of lymphosarcoma and Hodgkin's disease.

While Doctor Coley believes that the present trend in the treatment of these cases is toward irradiation, he pointed out that those who have had a large experience with irradiation in this type of tumor admit that the treatment is only palliative and practically never yields a permanent cure. Desjardins and Ford, of The Mayo Clinic (J.A.M.A., p. 925, September 15, 1923), in 1923 stated that the only form of treatment that exercised noteworthy influence on lymphosarcoma was irradiation; and in a later paper (J.A.M.A., October 8, 1932) Desjardins stated that a "permanent cure of lymphosarcoma by any method of treatment was unknown." In view of these statements Doctor Coley called attention to his report of 1928, made before the American Surgical Association (ANNALS OF SURGERY, October, 1928), covering 264 cases of lymphosarcoma and Hodgkin's disease in which he reported twenty-one five-year cures; lymphosarcoma (eighteen), Hodg-

kin's disease (three). In every case but one there was a microscopical confirmation of the diagnosis. The toxins alone had been used in sixteen cases, the toxins and irradiation in four, and one case was treated with the living cultures of erysipelas. Three of the patients had remained well for more than twenty years; and eleven, from ten to twenty years.

In view of these results in a condition admittedly hopeless as regards a permanent cure by either irradiation or surgery, the question naturally arises, Why are the toxins not more widely used at present? Doctor Coley believes one reason may be that lymphosarcoma is such a rare disease that the ordinary surgeon sees only an occasional case, too few to permit him to test the various methods of treatment. Second, most of the cases are sent to the larger hospitals where only two methods are generally employed, *i.e.*, surgery and irradiation. A third reason, and, in Doctor Coley's opinion perhaps the most important, is that a relatively much greater amount of time and personal supervision on the part of the attending surgeon is required for the administration of the toxins.

OBSERVATIONS ON DISABILITIES FOLLOWING TRAUMA OF THE EXTREMITIES

Dr. Donald Gordon read a paper with the above title.

Dr. Gordon illustrated his paper by the following case. An Italian housewife, aged sixty-one, applied to the Out-Patient Department of the Fifth Avenue Hospital, August 29, 1933, complaining of pain in the left wrist and bleeding from face and forehead. A short time before admission, she had stumbled while going downstairs, and fell several steps. She did not lose consciousness and walked to a drug store, where the druggist referred her to the hospital. On examination she was found to have contused abrasions of the left cheek and forehead with ecchymosis of the left lower eyelid, hæmorrhage from nose, and a possible fracture of the left radius. A temporary splint was applied to the left forearm and hand. Suitable treatment was given for the abrasions and an X-ray made immediately. She was examined by an attending surgeon, who, after viewing the films, considered that a reduction was not indicated. He advised that anteroposterior molded plaster splints be applied, which was done by the interne. She was told to keep her arm elevated, and to return to the clinic the following day, which she did.

Her record shows: August 30.—Examined, comfortable. September 11.—Twelve days later, splint O.K., bandage loosened. September 20.—Two weeks later, posterior splint removed, and daily hot soaks ordered. October 4.—Two weeks after last visit, same treatment. October 11.—Forty-one days or about six weeks after injury, she was seen by Doctor Gordon for the first time when she returned for physiotherapy. The anterior splint was still being used, as the hand and wrist were swollen and painful. There was pitting of the soft parts on pressure. There was a bony deformity at the lower end of the radius suggesting posterior displacement of the distal fragment or non-reduction of the original displacement. The metacarpophalangeal and the interphalangeal joints were stiff, movements were limited by pain in these joints and wrist. Active and passive movements

showed wrist flexion 10°; extension 5°; adduction and abduction about 10°; supination 0. Metacarpophalangeal joints, flexion 45°; proximal interphalangeal joints 45°; distal interphalangeal joints 15°.

Exceeding the degrees of movements as above gave pain in the joint moved, and not any other, nor was there any referred pain to the region of the tendon sheaths suggesting tendon involvement. The tendons did not appear to be the cause of the pain, nor the lost degrees of motion, as tendon action which permitted 45° flexion of proximal joints should have permitted more than 15° in the distal joints activated by the same tendons. A second X-ray was taken.

The X-ray report of the original film taken August 29 was "Colles' fracture of left wrist. The fragments are in good position."

The report on the films made October 11 was "films of the left wrist show union of fracture of radius. The articular surface shows a slight tilt toward the dorsal surface of forearm not present previously. Styloid of ulna has failed to unite. Though no mention is made of decalcification, lantern slides show this change also."

The case is shown as an example of stiff fingers following a simple fracture of the lower end of radius and styloid of ulna with delayed secondary displacement of the radial fragment. The stiff fingers are due, he believed, to what he termed post-traumatic peri-articular fibrosis.

The picture presented is one of loss of function of joints, following persistent swelling, caused by a simple fracture proximal to the joints involved, and augmented by the displacement. In this particular case he believed the swelling could have been avoided sufficiently to have prevented to a large degree the present existing process by the following:

(1) Greater assurance that the arm was adequately elevated to avoid swelling and permit finger movement.

(2) More loosely applied dressings.

(3) Application of a type of retention dressing with the wrist in flexion, which would have prevented the tilting of the distal fragment backward, though the position used and type of dressing is one most commonly seen.

(4) Early recognition of the secondary displacement which augmented the distal swelling and its correction.

(5) The recognition of the fact that the persistent swelling was a symptom of some complication, which called for investigation and correction.

(6) Seeing the case more frequently than was recorded and seeking for the cause of the symptoms presenting.

Dr. H. H. M. Lyle remarked that the loss of function of any part is directly proportional to the destruction of tissue, the degree of infection and the length of time that elapses before the part is put to functional use. If, in addition, the vasomotor mechanism is separated from the central nervous system due to damage or pressure of dense scar tissue, a local excess of activity takes place in the peripheral part and we get dilatation of the vessels, a thickening of the joints with extra intra-articular contractures and articular fibrosis. In the trauma of fractures we can get this phenomenon of interruption of vasomotor impulses with the resulting œdema, *etc.* Certain fracture cases, although well treated, develop the syndrome described by Doctor Gordon. Why this occurs in some cases and not in others is hard to say, yet we suspect that there is a neurogenic element or rather

a neurovascular element underlying it. In our experience these cases occur more often in women past middle age. They suffer a mild Colles' fracture, are apparently well treated, yet we get œdema, bony atrophy and a stiff wrist. Doctor Gordon's paper rightly emphasizes the old dictum that there is a best position for every joint and every injury and this position, in the majority of cases, is the physiological position of rest.

Dr. Kirby Dwight said that this condition has bothered more young surgeons than almost any other. His own introduction to a hand of this type was as a junior in the hospital on the ambulance staff. The first fracture case he had was that of a woman of forty years of age with a simple Colles', but the hand turned out to be like the one that Doctor Gordon has shown. Later, working in the dispensary with Doctor Gordon, the speaker saw a great many more of them but they could not determine any etiology for it. They could not predict in what case that result might appear. All they knew was that it followed some kind of injury or infection; if an injury, it had to be severe, it did not occur in people below the fifth decade of life and four out of five of the patients would be women. Some of the cases came in for the first time two or three weeks after the injury without having been treated, so it was not due to splintings. In some cases there was a suspicion that it had something to do with the amount of swelling, but it was impossible to predict this condition by the presence or absence of swelling. Doctor Dwight had called it "glossy hand" and had had no idea of the pathology. But the morbid changes go all through the tissues of the hand. It is not a true arthritis, because there is no pain within the limits of easy motion of the joints. The skin shows atrophic changes. The nearest approach to the etiology was that which Doctor Lyle had suggested. Due to widespread atrophy of bone and skin there must be some atrophic process of neurogenic origin. This class of case should be made a clinical entity, understood by everyone. It is a comfort for a surgeon to know that the bad result which he gets is not caused by his failure to give the patient proper treatment.

Doctor Gordon, in closing the discussion, said that he thought this condition should be presented in such a way that it would be generally understood, as he believed it could be prevented in many instances.

In reference to Doctor Lyle's mention of the possibility of a neurological factor entering into this condition, the speaker cited a case which he took care of last winter, where the median nerve had been stretched over a displaced semilunar bone for three months, causing a great deal of swelling of the hand. Before operating upon him, Doctor Gordon was apprehensive of the onset of this peri-articular fibrosis, but it did not develop, probably due to the use of efficient elevation to avoid post-operative swelling.

As to the neurogenic theory, Fontain and Herman, from the LeRiche's Clinic, have stated that they had relieved post-traumatic osteoporosis by means of peri-arterial sympathectomy and ganglionectomy; but Doctor Gor-

don doubted that they had restored function as quickly as was claimed. Regarding the unreduced fracture, it will tend to produce swelling, and the first thing to do is to get an early reduction to as satisfactory a position as possible. As to the extension of the splint beyond the metacarpophalangeal joints, the speaker always used non-padded split plaster dressings which afford greater ease for the relief of pressure without danger of displacement, and facilitate motion of the parts requiring movement by not extending beyond the metacarpophalangeal joints. If the fracture is adequately immobilized, this will give greater mobility to the parts which should be mobilized, provided swelling is prevented by elevation. The plaster splint carried to the ends of the fingers and preventing movement of these is a real factor in producing this condition.

THE RECONSTRUCTION OF THE COMMON BILE-DUCT

Dr. Thomas H. Russell presented a woman, aged forty-two, whom he saw first January 20, 1931. She had been operated upon two days before for chronic adhesive cholecystitis and appendicitis. The gall-bladder and appendix were removed. At this time she was nauseated, the abdomen was moderately distended, her temperature was 101°, pulse 100, and there was a moderate degree of jaundice which was more marked in the sclera. The urine was port wine color. The blood was immediately examined for determination of the icterus index, which was found to be 55. The possibility of an injury to the common bile-duct suggested itself and immediate exploration of the duct was advised. At five o'clock that afternoon Doctor Russell opened the wound in the upper abdomen, which was done by simply removing all sutures of the abdominal wall. The common duct was easily found and the first ligature seen, which had been cut long, was found encircling the common bile-duct just above the point of junction of the cystic duct. There was also a ligature around the cystic duct just distal to the point where it had been cut in the performance of the cholecystectomy. The common bile-duct was gangrenous about the ligature encircling it. He removed the ligature and after making a longitudinal incision in the duct inserted a "T" tube. A cigarette drain was placed down to the foramen of Winslow and the wound closed in layers with plain catgut, and the skin with silk. The patient made an uneventful recovery. The icteric index was 30 the next day, and was 17 two days later. On the twenty-first postoperative day the "T" tube slipped out, and bile drained from the abdominal wound. The patient insisted upon going home February 28, four weeks from the day of the second operation.

Four days later, March 4, 1931, she was admitted to St. Francis Hospital, stating that the wound was continuing to discharge large quantities of bile, and that she was troubled with much abdominal distress after meals. Her stools were formed and of natural color. After a few days' rest in the hospital she felt better, until March 16, when there appeared to be slight jaundice; the icteric index was eleven. In a few days the jaundice disappeared and she felt well again. March 31, she was decidedly jaundiced and the icteric index was forty.

April 4, two months after the first operation, he reopened the abdomen, incising the old scar in the upper abdomen, and exposed the common duct. He found a stenosis of the duct at the site of the old trouble about one inch in length. This stenotic part of the duct was excised and an effort made

to bring the two ends of the duct together over a "T" tube, but he was unable to get accurate apposition of the ends, hence the chance of a recurrence of the stricture at this site was most probable.

Reports of various operations designed to establish a fistula to later anastomose into the stomach have heretofore been so unsatisfactory in a large percentage of cases that he adopted a different procedure, bringing the long piece of the "T" tube up along the posterior wall of the stomach just proximal to the pylorus, sewing a piece of the gastrohepatic omentum about the tube so as to fix it to the stomach wall with the idea of having a sinus form along the stomach wall to later open into the stomach. This was accomplished very easily. The abdominal wound was again closed around the tube and a cigarette drain, which drain was removed on the third post-operative day. Bile drained from the abdomen around the "T" tube for several days, then ceased. In a few days the "T" tube was pinched off with a Murphy-drip clamp for several hours a day until finally the patient was taught to unpinch the clamb for a few minutes night and morning, and to keep the tube in position by means of adhesive strips.

The patient was discharged from the hospital May 2, 1931. She returned every few weeks for examination until October 20, 1931, when she was readmitted for the final operation. She had gained in weight and stated she felt well and had been doing her usual household duties.

On October 23, 1931, the icteric index was ten. On October 26, almost seven months from the time the tube had been inserted, the sinus around the tube was dissected free down to where the tube was fastened to the posterior wall of the stomach. A two-inch incision was made through the anterior wall of the pyloric end of the stomach parallel to its long axis, then a stab wound made through the posterior wall of the stomach into the sinus containing the tube. Several inches of the long end of the tube were cut off and the tube pulled through into the stomach. The tube was then cut off flush with the inner surface of the stomach, but was not removed as the tube had been retained with so much difficulty that he thought it would soon be discharged into the stomach. The anterior wall of the stomach was closed transverse to its long axis to avoid narrowing of the stomach at this point. The excess sinus was cut off and the end sutured. The abdomen was closed without a drain. The patient made an uneventful recovery. November 12, 1931, a flat X-ray of the abdomen showed the tube still in position. The patient left the hospital November 14 and has returned monthly for X-ray. The last one, taken February 2, 1932, showed the tube still in position. She is now feeling well and doing her regular work. All the above operations were done with spinal anæsthesia using two cubic centimetres of spinocaine.

August 3, 1932, nine months after the last operation and sixteen months after the tube had been inserted, this patient returned complaining of a ventral hernia. The herniation which presented itself was weakness along the lower end of the scar, which was really not a bad hernia but I grasped this opportunity to remove the tube which X-ray showed still present between the common duct and the stomach. August 10, 1932, with spinocaine anæsthesia, the old scar was excised. The anterior wall of the stomach opened parallel to its long axis. The tube which was presenting itself through the posterior wall of the stomach was grasped with a hæmostat and removed.

Bile was flowing freely through the new opening. The anterior wall of the stomach was closed transversely to the line of incision and the hernia repaired without drainage.

The patient has remained well except for occasional gas, and has gained thirty pounds in weight since the last operation fourteen months ago.

Dr. Chas. Gordon Heyd stated that there had been developed a large literature on injuries and reconstructive surgery of the common bile-duct. It was unfortunate, however, that all these data were purely along the lines of experimental operations on animals or even on the cadaver. It was noteworthy that in a field of brilliant surgery and expert operators there were relatively so few successful cases of actual reconstruction of the common duct. The great majority of injuries to the common duct had their origin in operative accidents and most of the injuries to the common duct were not recognized at the time of operation but became manifest at varying intervals of time after operation. It was well to remember that there were two particular classifications in which plastic or reconstructive operations were indicated: the first group were the cases in which the gall-bladder was removed and there developed an impassable stenosis of the common duct, and the development of chronic jaundice. In this group of cases nature availed herself of the tremendous distention power of the common duct. The biliary ducts—common or hepatic—above the obstruction became greatly distended or dilated. It was in this type of case that the various operations for the anastomosis of the proximal portions of the duct to either the stomach, duodenum or intestine were possible. Mayo, in 1905, united the hepaticus to the duodenum and the functional result was excellent. Where this technic is possible the result will be, by and large, uniformly good. The second great group of cases are those in which the gall-bladder is absent, there is an impassable stenosis of the common duct and the presence of a persistent, external, biliary fistula. In this type of case the common duct below the stenosis is ordinarily of normal size and the common duct or hepatic duct above the stenosis is usually normal, but the removal of the stenotic portion brings into being a defect in continuity that cannot be abridged by end-to-end anastomosis or any of the plastic types of operation on the common duct. Surgical correction depends upon the ingenuity of the surgeon, for he must utilize some indirect method to accomplish continuity of the common duct and adequate biliary drainage. The condition of these patients is indeed horrible. The operative risk is great and the technical difficulties in many cases seem almost insurmountable. Doctor Russell's case presented a graded series of operative steps and there is every reason to believe that to-day, nineteen months after his reconstructive surgery, the patient is, to all intents and purposes, cured. The introduction of the "T" tube and carrying the long arm of the "T" tube across the posterior surface of the stomach and covering the "T" tube with omentum created a most admirable external biliary fistula. The simplicity with which this external biliary fistula was turned into the stomach was most praiseworthy. The final step in recovering his tube completed a very cleverly thought-out plan of graded steps for the correction of the condition.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING HELD MARCH 6, 1933

The President, Dr. John Speese, in the Chair

Calvin M. Smyth, Jr., M.D., Recorder

TOTAL GASTRECTOMY FOR CARCINOMA OF THE STOMACH

Dr. John B. Flick reported the case history of a man, aged fifty-five, born in Italy, who was admitted to Jefferson Hospital December 19, 1930, complaining of epigastric distress, vomiting and loss of weight and strength. The symptoms began in July, 1929. At first vomiting occurred several times a week and then daily. The vomitus contained food which he had taken at his last meal. There was never, to his knowledge, any blood in it. He had lost thirty pounds in weight in six months. He had discomfort after meals, but no definite pain. The discomfort was relieved by vomiting. He had always been healthy until the onset of this illness, except for an ischiorectal abscess which was drained in 1905 and some "heartburn" in 1918 which soon disappeared. He had used alcoholic beverages and tobacco in moderation. On admission the patient appeared somewhat emaciated. His abdomen was scaphoid. The edge of the liver could be felt but there was no mass palpable and there was no tenderness. The blood Wassermann reaction was negative; hæmoglobin, 78 per cent.; red blood-cells, 4,250,000; white blood-cells, 6,000; and blood-pressure 108 systolic and 66 diastolic. Temperature and pulse were normal. The non-protein nitrogen, creatinin and sugar of the blood were within normal limits. The urine was negative. An X-ray examination showed what was thought to be a carcinoma involving the pars media and extending to the pyloric end of the stomach.

December 26, 1930, upon operation, the stomach was found to be small, its walls were thickened and there was marked induration of the pars media and pyloric end. It seemed to be almost completely involved in a carcinoma of the linitis plastica type. There were some enlarged lymph-nodes along both curvatures close to the stomach. There was no gross evidence of involvement of the liver or other viscera. It was obvious that no part of the stomach was sufficiently free of disease to permit of a gastrojejunostomy and a total gastrectomy was, therefore, decided upon. The duodenum was divided between clamps, but fearing that the division had been too close to the pylorus, a second clamp was placed behind the first and an additional section of duodenum removed. The stomach was freed from its omental attachments, taking with it the enlarged lymph-glands, several of which were along the coronary artery. The latter artery was doubly ligated with No. 2 chromic catgut proximal to the enlarged glands and divided. The stomach was then turned up and used as a tractor to expose the abdominal œsophagus. A loop of the jejunum was brought through the mesocolon and approximated to the œsophagus with five interrupted sutures of linen thread. An œsophagojejunostomy was done using two rows of continuous sutures of No. 0 chromic catgut. The stomach was not cut away until the inner suture layer was almost complete. No clamps were used. The jejunum on either

side of the anastomosis was fastened to the diaphragm to relieve the strain on the anastomosis. The margins of the opening in the mesocolon were sutured to the jejunum with a few interrupted sutures and the abdomen closed. The operation was a long one and the patient was in a state of shock at its termination. He was given normal salt solution by hypodermoclysis, intravenous infusion of glucose and later a transfusion of 240 cubic centimetres of blood. He reacted from the shock, but developed almost complete suppression of urine and died on the third post-operative day.

Forty-eight hours after operation his blood non-protein nitrogen was 60.6 and creatinin 9.44. Before death there was great restlessness, muscular twitchings and his temperature rose to 106.8° F. There was no vomiting nor any indication of peritonitis. Permission for autopsy could not be obtained. The laboratory report upon the specimen removed was: Diffuse carcinoma of the stomach (leather bottle type). Linitis plastica.

ABDOMINAL ACTINOMYCOSIS

Dr. John H. Gibbon, Jr., by invitation, reported the case history of a Negro male, twenty-four years of age, who was admitted to Pennsylvania Hospital in the service of Dr. Charles F. Mitchell, March 14, 1932. Three days prior to admission he had taken Epsom salts and the following day developed pain in the right lower quadrant of his abdomen. He was nauseated but did not vomit. Physical examination was negative except for marked rigidity and tenderness in the right lower quadrant of the abdomen. His temperature was 99.6° F.; pulse, 84; white blood-cells, 20,400 per cubic centimetre; urine, negative.

Under spinal anæsthesia, the abdomen was opened through a right lower rectus sheath incision. There was no free fluid in the peritoneal cavity. A mass surrounded by omentum was palpated in the region of the cæcum. The appendix was markedly swollen and covered with a fibrinous hæmorrhagic exudate. Examination showed a small perforation at its middle from which pus exuded. The appendix was removed and the stump inverted. The wall of the cæcum was not thickened and appeared normal. Two rubber-covered gauze drains were inserted and the abdomen closed. There was a slight febrile reaction following operation, but the temperature was normal on the seventh day when the drains were removed. He was discharged from the hospital twenty days after operation with a small draining sinus from which protruded exuberent granulation tissue. The blood Wassermann reaction was strongly positive and anti-luetic treatment with mercury and iodides was started prior to his discharge from the hospital. A small superficial ulcer over the lower third of his left tibia was dressed with mercurial ointment. The patient was uncoöperative, and returned at long and irregular intervals for the anti-luetic therapy and the dressing of his wound and ulcer of the leg. He was not seen from May 13 to August 5, when he returned to the hospital because of fever and a marked purulent discharge from his abdominal sinus. He said that his abdominal wound had never healed, and that the discharge had increased during the last two weeks in July. August 7, a superficial fluctuating mass near the old abdominal sinus was incised and pus evacuated. The blood Wassermann reaction was still strongly positive, and mercury and iodides were given.

The continued discharge from the abdominal wound was thought to be due to his untreated luetic infection, but the possibility of actinomycosis was suggested. A smear of the pus from the abdominal wound on August 17

showed many cocci and bacilli, but no ray fungi. There was no growth of the culture in six days.

August 26, another large fluctuating mass above the right iliac crest was widely incised under nitrous-oxide oxygen anæsthesia. The abscess cavity lay between the skin and the abdominal muscles. It was multilocular but the partitions could easily be broken down with the finger. A large quantity of pus and débris was evacuated. No connection with the original sinus of the anterior abdominal wall could be discovered. The original sinus was widely opened and both cavities were packed with iodoform gauze. Actinomycotic granules were now found in the pus at the time of operation and typical ray fungi were seen under the microscope. Microscopical examination of the tissue from the abscess wall showed colonies of actinomyces. (Fig. 1.)

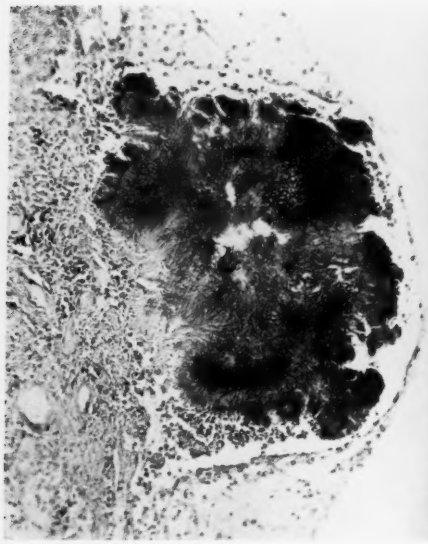

FIG. 1.

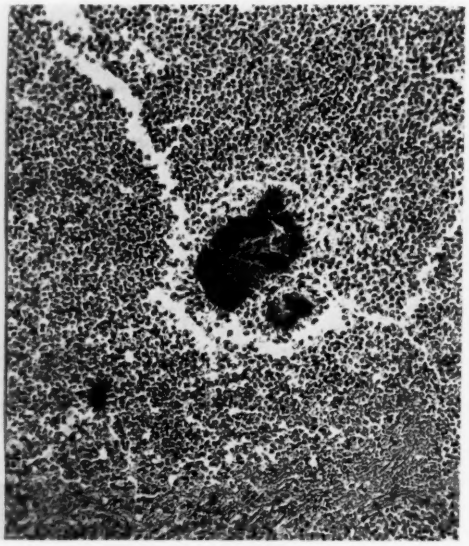

FIG. 2.

FIG. 1.—Photomicrograph (x 175) of tissue removed from the wall of the abscess in the right flank, August 26, 1932. The bacterial stain used shows the Gram-positive filaments of the actinomyces in a dense interlacing network in the colony.

FIG. 2.—Photomicrograph (x 175) of tissue at the border of the hepatic abscess. There is a large dense colony of the ray fungus at the centre and two smaller ones nearby. No normal hepatic tissue is shown.

Following operation, the daily dose of potassium iodide was rapidly increased to 140 grains. The iodoform gauze packing was removed on the second post-operative day. Carrel tubes were inserted and the abscess cavities irrigated with one-third strength Lugol's solution every second hour during the day and every third hour at night.

X-ray examination of the chest September 1 showed no involvement of the lungs, ribs or thoracic spine. Repeated urine examinations were negative. The patient was anæmic: Hæmoglobin, 53 per cent.; red blood-cells., 2,890,000; and white blood-cells, 29,700. The differential count was normal with 76 per cent. polymorphonuclear neutrophiles. From the time of admission the patient's temperature had varied between 99° and 102° F. As there was no abatement of fever following the last operation it was thought that surgical drainage was inadequate. September 2, under gas-oxygen anæsthesia, an incision was made from the lateral border of the right lower rectus sheath to the lumbar triangle of Petit, connecting the two suppurating abdominal wounds. This necessitated dividing all the abdominal muscles

attached to the crest of the ileum, thus producing one large, widely opened cavity. The cavity was extended up along the lateral and posterior wall of the cæcum and ascending colon, and down as far as Poupart's ligament. Bleeding from the friable necrotic tissues lining the abscess cavity was controlled by packing with iodoform gauze. A blood transfusion of 500 cubic centimetres was given by the direct method the following morning. Two days after operation the iodoform packing was removed, and the wound loosely filled with gauze. The gauze was changed daily and was saturated with Lugol's solution every second hour during the day and every third hour during the night. Potassium iodide was increased to 180 grains a day.

Two weeks after operation the patient's temperature, which had been normal for six days, began to rise again. An X-ray treatment was given, but was followed by such a severe systemic reaction that it was not repeated. The wound filled in with granulation tissue, but sinuses developed in the posterior portion, and despite continuous irrigation with Lugol's solution through catheters, several more abscess cavities developed in the lumbar region and over the buttocks. These were opened and drained. The patient gradually became more emaciated and weaker and the hectic temperature continued. The anæmia persisted, but did not become more marked. There were never any symptoms of pulmonary involvement. The patient became comatose on January 26, 1933, and died a few hours later.

At autopsy there was some serous effusion in the pericardium and pleural cavities and congestion of the bases of the lungs, but no gross evidence of disease of the thoracic organs. There was a small amount of clear straw-colored fluid in the peritoneal cavity. The peritoneum was smooth and glistening. The omentum was slightly adherent to the cæcum and to the abdominal wall at the site of the appendectomy scar. There were no other intraperitoneal adhesions. The edge of the liver extended just below the costal margin. There was general enlargement of the mesenteric lymph-nodes, but no evident disease of the large or small bowel. The sinus tracts in the right lower quadrant of the abdomen were found to extend into the retroperitoneal tissues about the right kidney, and to involve the right psoas muscle. The vertebral discs and the bodies of the second to the fifth vertebræ, inclusive, showed some softening. The tracts extended over the sacral promontory into the left psoas muscle. The more extensive involvement, however, was on the right side of the spinal column. There were areas of necrosis throughout the right psoas muscle and there was some roughening of the right twelfth rib. Posteriorly, the sinuses followed the fascia planes from beneath the twelfth rib to the lumbar region, where drainage had been instituted.

The liver was the only organ showing gross involvement by the actinomyces. A large abscess was found in the central portion of the liver substance near the gall-bladder and the left lobe. The abscess was eight centimetres in diameter and filled with creamy pus. No sulphur granules were seen and smears showed bacilli but no fungi. There was no growth on culture. Microscopical examination of the abscess wall in the liver showed colonies of the ray fungus. (Fig. 2.) Ray fungi were seen in the lungs on microscopical examination. The mesenteric lymph-nodes showed only the histological changes incident to inflammation.

Doctor Gibbon remarked that actinomycosis is not a rare disease in this country. In 1925, Sanford and Voelker[1] reviewed 670 cases reported in

the United States. Eighteen per cent. were abdominal. Good,[2] in 1931, reported sixty-two cases from The Mayo Clinic in which the disease was primary in the abdomen, and in only eight of these cases was the disease arrested. The origin of the infection in the case reported here is not clear. There was no evidence of involvement of the mouth, neck or respiratory tract. The cæcum was apparently normal at the time of the appendectomy. Gross dissection of the appendix, and repeated microscopical examinations, failed to reveal the presence of any actinomyces.

Cure or arrest of the disease lies in early and energetic treatment. The failure in this case may be ascribed to the delay in establishing the diagnosis. Probably the sinuses should have been widely opened as soon as they appeared, but the patient's failure to respond to the extensive and almost mutilating incision of his abdominal wall deterred further surgical efforts. It is difficult to estimate the effect of X-ray and radium therapy upon the disease as they have practically always been used in conjunction with other methods of treatment in the arrested or cured cases which have been reported. Probably in this case intensive X-ray therapy should have been used after the anæmia had been controlled.

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Dr. Richard H. Meade said that for five years he had been following a patient with this disease. He started off with an infection of the jaw which cleared up after extraction of a tooth. Some weeks later he developed pneumonia, then empyema. He was operated upon for empyema and in a few months developed chest-wall and abdominal-wall abscesses, none of which showed the causative agent. He had diabetes in addition. About four months after the empyema was drained, typical sulphur granules were obtained from all wounds. This man had treatment by iodine and X-ray as well as by surgery and after being in the hospital fourteen months returned home with several draining sinuses, apparently to die. Three months after returning home, without any special therapy whatever, all the drainage stopped and he was free from all evidence of disease for twenty-three months. At that time he returned for study with some evidence of lung involvement. He has now continued another year in comparative health and requires no treatment except for the diabetes. We are at a complete loss in this case to give credit to any single form of therapy. Doctor Wangensteen reported a case last year successfully treated by surgery alone and there are several other reports indicating that sugery offers the best outlook, rather than X-ray and iodine.

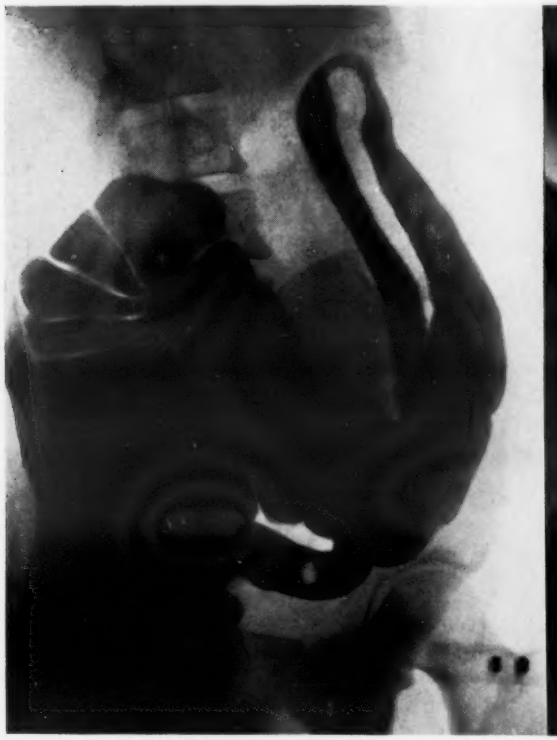

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 3.—Barium enema May 8, 1931, showing polyp vacuole and loss of haustration of the large gut from the rectum to the middle of the transverse colon.
Fig. 4.—Barium enema June 19, 1931, one month after transverse colostomy. No change in appearance of bowel. Polyps still noted.
Fig. 5.—Barium enema November 7, 1932. No further bowel symptoms, but marked contracture of the bowel lumen may be seen with disappearance of the vacuolization due to the polyp.

ULCERATIVE COLITIS

Dr. L. F. Ferguson presented a woman, thirty years of age, who had an attack of what was called intestinal influenza in 1927 at which time she suffered from a bloody diarrhœa. She was confined to a hospital for a period of six weeks. The bleeding and frequency of movements decreased somewhat but returned in attacks and in January, 1931, her physician recommended extraction of her teeth. She rapidly lost weight and strength following this operation, complained of marked abdominal pains and had such frequent bloody bowel movements that she was unable to leave her home. When first seen April 4, 1931, she had such marked prostration that she was continually dizzy and could barely walk. She was having from ten to fifteen bowel movements per day, all of which contained much pus and blood. Her hæmoglobin was 35 per cent. and her red-cell count about 2,000,000. Following three transfusions she improved markedly. Proctoscopical examination May 4, 1931, showed an extensive ulceration of the rectum and lower bowel with marked bleeding. At a point about ten centimetres from the anal orifice, several polyps were noted between the ulcerations. The lumen of the bowel was about two centimetres in diameter. A barium enema (Fig. 3) showed a loss of haustrations extending to the middle of the transverse colon with areas of polyposis throughout the involved portions. Because of the marked constrictions of the lumen of the gut, the patient was advised to have a colostomy performed. This operation was done May 16, 1931, in the Philadelphia General Hospital in the service of Dr. E. L. Eliason. The abdomen was opened through a lower right rectus incision under spinal anæsthesia. The large gut from the middle of the transverse colon downward was tubular in shape, thick and about two to three centimetres in diameter. Proximal to this point the gut was normal in appearance. A right gridiron incision was then made and the middle portion of the transverse colon delivered to form a loop colostomy. Two further transfusions were given before the patient was discharged from the hospital. At the time of her discharge her red-cell count was 3,620,000 and the hæmoglobin 70 per cent.

Just before her discharge from the hospital a barium enema (Fig. 4) showed an X-ray picture essentially the same as before the operation.

The patient has been seen at frequent intervals since leaving the hospital. She has gained weight and is now able to live a normal life. Usually she has two bowel movements per day and wears a colostomy bag only for protection. She has been receiving autogenous vaccines of hemoliticus streptococcus equip and non-hemoliticus staphylococcus albus.

Proctoscopical examinations now show an almost complete healing of the ulcers of the bowel but the lumen of the gut is so contracted that only a very small proctoscope can be passed. Because of the extensive polyposis the question was raised as to whether malignant degeneration should be looked for and for this reason a third barium enema examination (Fig. 5) was made in November, 1932. The marked constriction of the bowel is easily noted but the outline of the gut is smooth and the previously observed polyps seem to have largely disappeared.

The speaker added that proctologists and gastroenterologists hailed the work of Bargen as a new epoch in the treatment of chronic ulcerative colitis. This discouraging disease which has resisted therapeutic efforts seemed to have succumbed to rational methods of treatment when a causative

organism was found by means of which immunizing vaccines or sera could be prepared. Unfortunately, Bargen's work has not been universally duplicated, but the use of autogenous vaccines has proved beneficial in many cases. Their experience in the Proctology Clinic at the University of Pennsylvania Hospital has been that relatively few cases of ulcerative colitis will show the Bargen diplococcus, although his culture media have been used and his technic closely followed. They have, however, been able to isolate many types of streptococci from cultures made directly from the ulcer at proctoscopical examination, and administration of vaccines prepared from these cultures has given excellent results in many of these cases.

Vaccine therapy is of particular value if the patient is seen during the early stages of the disease. In the later stages there are marked inflammatory changes with stricture formation and often inflammatory polyposis. In this stage vaccine or other conservative therapy is rarely successful and the patients continue semi-invalids, often unable to leave their homes because of the necessity for frequent bowel movements. In such cases operative intervention may often enable the patient to live a normal life.

The operations which have been proposed for the treatment of ulcerative colitis may be divided into two groups. The first group, ileostomy and appendicostomy, are often used in the active stage of the disease. Regan and Mensing employ ileostomy as a means of producing physiological rest during the acute stage, with later anastomosis after the disease subsides. Appendicostomy has been used to make possible irrigation of the diseased bowel. The success of these procedures has not been great, and it is certain that conservative therapy has given as good results.

The second type of operation is used in the late stages of the disease, when contracture of the bowel wall is a constant feature. Permanent drainage of the gut above the affected area is the indicated surgical procedure. The site of the drainage must be determined by the extent of the bowel involvement as shown by barium enema. When the entire colon is involved, ileostomy is the indicated operation; when only part of the large gut is diseased, a colostomy proximal to the diseased area should be performed. Colostomy with resection of the involved colon is an extensive operation, rarely indicated to effect a cure.

Doctor Ferguson, in closing, said that he would like to have some opinion expressed as to whether or not colectomy should have been performed in view of the widespread polyposis. The patient was in such poor condition that he did not wish to subject her to such extensive surgery. Is it possible in these cases that drainage of the bowel will suffice?

Dr. Calvin M. Smyth, Jr., said that it is generally conceded that polyposis is the one lesion of the large bowel that is definitely pre-cancerous. In many cases of diffuse polyposis a painstaking microscopical examination will show that malignant degeneration has begun to take place in one or more of

the polyps. It is conceivable that an operation such as the one described by Doctor Ferguson upon this patient might result in a cure of the colitis, although the speaker wondered just how Doctor Ferguson arrived at the conclusion that the involvement of the colon was limited to such a restricted area. This is not the usual case in ulcerative colitis and it would, therefore, seem that ileostomy, which excludes the entire colon, would be a more logical procedure. It is evident that simple drainage has in a large measure relieved the symptoms attributable to colitis in this patient, but is it possible to state from the X-ray appearance alone that the polyposis has cleared up? The speaker believed that, as a general rule, the interests of the patient in cases of this type are best served by a preliminary ileostomy followed by colectomy and restoration of continuity at a later date. It is, of course, necessary to allow a sufficient interval between the two operations. By thus staging the surgery a poor or indifferent risk may often be converted into a good risk and the patient thereby be given the benefits of complete surgery.

PILONIDAL CYSTS

Dr. S. Dana Weeder read a paper with the above title for which see page 385, vol. 98, September, 1933, Annals of Surgery.

Dr. Hubley R. Owen remarked that the terms pilonidal cyst, sacral dermoid, sacrococcygeal cysts, and piliferous dermoids are somewhat erroneous inasmuch as a true cystic condition is decidedly rare. We find that the same condition, not often it is true, in the anterior raphe or line of fusion elsewhere. A similar condition under the hyoid bone was reported by Massé, in 1887. This patient had the same pathological entity in the sacrococcygeal region. In another patient the cyst was found over the sternum. In one of the speaker's cases the tumor extended as high as the lumbar region.

The term "pilonidal" is derived from the Latin composed of "pilus" for hair and "nidus" for nest or focus. The implication of this term can be only one of two states, that is, it is either a sinus or a cyst having hair as its focus. Neither of these conditions is true always. Lawson Tait and many others consider the condition to be a persistent remains of neurenteric canal. Féré believes it to be caused by failure of two halves of the body to properly unite behind, while others believe it to be due to an invagination or retraction of the skin with a subsequent partial degeneration, and as recently as July, 1931, Stone, of Baltimore, advanced the imaginative theory that it might be traceable to an evolutionary persistence of the Avian preen gland from which the bird obtains oil with its beak pressing down its feathers. Doctor Owen suggested the term raphe inclusions because of the fact that these inclusions occur in the seam of the body or mid-line, not only in the sacral and sacrococcygeal region, but also, as noted above, in the region of the hyoid, the sacrum and lumbar vertebræ. The histories of a large number of cases occurring in three of the large hospitals in Philadelphia

disclose certain salient facts: (1) That less than 10 per cent. occur in females. In the speaker's series of thirty-one cases there was but one in the female. (2) Practically every individual in the group was of the heavy or obese type—many of them classed as pituitary type. In one case a note had been made of the peculiar sharp demarcation of the hair above and below the level of the sacro-iliac junction. Below the hair was heavy, matted and tangled—almost ape-like, while above it was thin and of fine texture.

Doctor Stone emphasized the fact in 1924 that not one had occurred in a member of the Negro race and in two of the hospitals whose histories were examined the Negro census equaled that and even surpassed the white census. Furthermore, the condition appeared only in members of the Caucasian race. Not one instance was found in a member of the black, red or yellow races. This fact may be a coincidence. It is also true of the histories examined whereas the clinical studies were not always complete, there was no positive Wassermann or Kahn reaction. There are a few interesting questions which might be asked: Why is it the condition does not manifest itself before adolescence and why is it apt to occur in the heavy obese type of person? Why does it occur so much more frequently in the male than in the female? Is it true that the majority of cases follow sedentary occupations? Does the sedentary occupation favor inflammatory change? Surely it is not because of laziness because it might then be more common in the Negro. The Negro appears to be hereditarily free of this lesion yet the white man, accepted as an older evolutionary animal, has this condition far more frequently. Is it because the white man's ability to fuse properly during his fœtal life is becoming less or is it due to early species cleavage?

Doctor Owen presented an analysis of his cases as follows:

SUMMARY OF THIRTY-ONE CASES OF DR. H. R. OWEN

Males			30
Females			1
Oldest	45	Duration	18 years
Youngest	23	Duration	18 months
Average age			31.1 years

Duration of Symptoms

Average	1.46 years
Shortest	2 days
Longest	18 years

Chief Complaint

Discharge	13 cases	Hair found	7 cases
Pain	8 cases	Sinuses—largest number of sinuses	4
Both	5 cases	Single sinus	14
Cyst of spine	5 cases	Multiple sinuses	6

Post-Operative Length of Stay in Hospital

Longest	27 days
Shortest	3 days
Average	10.1 days

Post-Operative Temperature

Normal	15 cases
Elevation	16 cases

Recurrence

Twenty-five cases have been followed for a period of over one year.
Two of thirty-one cases have had recurrence following reporter's operation.
Eight cases had been previously operated upon once.
One had had two previous operations.
One had had three previous operations.

Type of Operation

Lahey	5 cases
Excision with central drainage of wound	6 cases
Excision with packing	20 cases

Anæsthesia

Gas	3 cases
Ether	6 cases
Local	1 case
Gas-ether	9 cases
Spinal	12 cases

Complications

Secondary hæmorrhage	2 cases
Upper respiratory infection	1 case
Sacral teratoma undergoing sarcomatous degeneration	1 case

Dr. George P. Muller said that during the past ten years, in the University Hospital, he had seen thirty-five of these cases; thirty-one were in men and four were in women (11.4 per cent.)—a large percentage of women, according to most writers. One of these was a child of seventeen months. Omitting this patient the average age was twenty-six years. The condition is a very difficult one to treat owing to the long duration of the healing process and the frequency of recurrence. At the present time Doctor Muller is rather partial to the modified Lahey method in which only one lateral cut is made and the original incision sutured up.

Doctor Weeder, in closing, said that as to the terminology, he agreed "pilonidal" cyst was a bad term. As he has tried to show, the lining membranes of these cysts or sinus tracts will vary depending upon the time of inclusion of certain cells derived from the ectoderm. The early inclusions will be of completely potential cells in which case hair, sebum and sweat may accumulate in the cyst or be discharged from the sinus. Later inclusions would include impotential cells in which case stratified epitheliam would line the wall or tract and there would be an absence of hair, sebum and sweat. A percentage of both types would have as part of their wall a remnant of the medullary canal which has remained unobliterated, in which case the cells would be a type of embryonal neuro-epithelium. It would seem, then, that a better term would describe first the location of these cysts or sinuses and secondly suggest their origin as being faulty develop-

mental inclusions and obliteration of the medullary canal. These thoughts suggest the term sacrococcygeal medullary cysts or sinuses.

Most writers declare that the condition is found more commonly in the male than in the female. It happens, however, that in the four cases in which he has excised the coccyx there were three women and one man.

As to the time of appearance he believed this to be influenced by the incidence of injury. So often the patient gives the history of having fallen or injured the end of the spine. This injury seems to set up an inflammatory reaction.

Regarding treatment he has based it upon what appears to be the true etiology. A complete removal of the cyst or sinus wall will bring about a cure. If a percentage have as part of their wall a remnant of the unobliterated portion of the medullary canal or the sacrococcygeal joint, then it will be necessary to remove the coccyx in order to excise all that wall. Probably the type of closure of the wound has nothing to do with the matter of recurrence as wounds should close here as well as elsewhere if there be no pathological process at the base. The type of closure, however, does influence very decidedly the length of time for wound healing and whether or not there will result a painful scar. The double pedicle flap recommended by Lahey has proven to be most successful. Practically all the patients so closed were out of bed by the fourth day and out of the hospital in a week.

The coccyx should be removed in those patients operated on before by bloc dissection which have recurred; those in which the injection of lipiodol shows the sinus tract by X-ray to go into the sacrococcygeal joint; those in which the injection of methylene blue shows discoloration about the joint and those which show some suspicious type of tissue in the region of the sacrococcygeal joint.

CEREBELLAR ABSCESS

Dr. Hubley R. Owen presented a boy ten years of age, who was admitted to the Hospital of the Woman's Medical College June 6, 1932, giving the history of having been hit in the head by a baseball on or about June 4, 1932. No symptoms developed until June 14, 1932, when the boy complained of headache, nausea, vomiting and restlessness at night. The provisional diagnosis was possible fractured skull with signs of compression. Both ears have discharged at intervals for the past eight years due to otitis media at the age of two years.

Physical Examination.—Overdeveloped, stolid boy, not acutely ill. *Head.*—Eyes, pupils equal, react to light and accommodate. Ears, left ear impacted cerumen; right ear discharging freely. No mastoid tenderness. *Chest.*—Negative. *Abdomen.*—Negative. *Extremities.*—Babinski absent. Knee-jerks diminished. *X-ray of Skull.*—No evidence of skull fracture. Röntgen evidence of convultional atrophy. Sella is normal. *X-ray of Mastoid.*—Films of the mastoid show the left mastoid to be clear, cell outlines distinct and cells pneumatic. Films of right mastoid show marked clouding of the cells and cell outlines can be faintly recognized in places but there is ap-

parently considerable destruction of most of the cell outlines. Impression, mastoiditis right side.

Child complained of occasional nausea but constant headache. Headache increased in the afternoon. June 22, 1932, the child was quite sick, crying all day from headache. Examination of eyes by Dr. Mary Buchanan, ophthalmologist, showed "02 media clear. Discs well defined. The vessels full and discs quite red, although not so red as the rest of the fundus. No hæmorrhage or exudate as far as seen but patient is not coöperative and the details of the periphery are not obtainable through the small pupils. There is nothing suggesting brain lesion or choked discs Patient follows light, movements are full, and patient seems fully conscious. Cornea clear and pupils equal. Respond promptly to light." Examination by Dr. Winifred Stewart June 23, 1932: "All neurological signs negative. Spinal puncture, pressure 22 when not crying; 40 when crying. Five cubic centimetres spinal fluid removed and sent to laboratory. Vomited all food." Examination June 24, 1932 by Dr. George Wilson: "Child is drowsy and fusses when awakened. He coöperates not too well in examination. No cranial nerve paralysis. Pupils dilated with mydriatic. Performs finger-to-nose test on left side well, on right side with moderate ataxia. The tone of right upper extremity seems less than that of left. Deep reflexes in upper extremities unobtainable. In lowers these are present and a little subnormal. Plantar stimulation on left produces flexion. On right there is occasional extension of great toe which simulates a Babinski. Quite often, however, when right foot is stimulated, there is extension of left big toe. Position sense is normal in all four extremities, although he occasionally miscalled a position on the right side. He recognized objects with both hands, except that once he called a quarter, a key in right hand. Pain sense is normal. Abdominal reflexes could not be obtained. Knee to heel normal. Neck is slightly rigid. Boy cries out when head is flexed. Kernig sign not present. Boy is obese. External genitalia are small."

A tentative diagnosis of cerebellar abscess was made and the boy was operated upon June 25, 1932 under nitrous-oxide oxygen anæsthesia with ether maintenance. He was operated upon by two-stage operation as suggested by Rawling. First, relief of cerebellar pressure; secondly, radical mastoid. Six days later, a semilunar incision was made and a flap turned forward. Incision made through scalp at right inferior region just below the tentorium. Skull, which was about three millimetres thick in this region, was opened with Hudson burr and enlarged by röngeur forceps. Aspirating needle was inserted into right cerebellum and about 10 cubic centimetres of moderately thick greenish pus was aspirated. A hæmostat was plunged into the opening, opened and withdrawn liberating considerable additional pus. Abscess drained with small rubber tube. Culture showed hæmolytic streptococcus. The child made an uneventful recovery from this operation and June 29, 1932, mastoidectomy was performed by Dr. Emily VanLoon.

Necrotic bone and unhealthy granulation tissue were found in the mastoid cells but no frank pus was encountered. Pressure over the antrum with curette repeatedly elicited rhythmic jerky movements of both upper and lower extremities. No break in the continuity of the bone between the middle fossa and the mastoid or between the mastoid and the posterior fossa was encountered. Drain was inserted into the antrum and the skin incision closed with dermal sutures.

The child made an uneventful recovery from the second operation and was discharged in good condition July 25, 1932.

The case is reported principally because of the confusing nature of the symptoms. The first impression was fracture of the skull with compression from a slow extra or subdural hæmorrhage.

Dr. J. S. Rodman said that he had an opportunity of seeing this boy operated upon by Doctor Owen. It was remarkable that he got well so promptly and by such a comparatively simple surgical procedure. The wound was drained readily through an exposure which ordinarily would not reach a cerebellar abscess. It is difficult to prove the exact location of this abscess but the speaker wondered whether this was an extradural abscess rather than one within a lateral lobe of the cerebellum. Most of these abscesses follow middle-ear disease and a considerable number are cerebellar, but those seen by Doctor Rodman have been approachable only from the post fossa itself. He raised this question as a matter of interest; it cannot be proven and is probably only an academic point as to whether this was within the lobe of the cerebellum or not.

Doctor Owen, in closing, said that the first exploration was made below the tentorium. He did not find pus in the cerebellum at the first exploratory puncture so continued the incision above into the cerebellar pontine angle but as he was unable to find pus in this location, he returned to the cerebellar region, re-explored with an aspirating needle and found the pus as noted in the case history. He was quite sure that the pus was not subdural as there was cerebellar tissue beneath the dura and pus was found rather deeply within the structure of the cerebellum.

THE PROBLEM OF RECURRENT HERNIA

Dr. Calvin M. Smyth, Jr., read a paper with the above title.

Dr. Hubley R. Owen said that he had had the opportunity in the past twenty-five years to operate upon a large number of hernias of almost every character. These were operated upon at the Philadelphia General, Jefferson, and the Woman's College Hospitals. Most of these operations were performed on policemen and firemen. It has been possible to conduct an accurate follow-up survey of 350 of these men upon whom he had operated for hernia.

Doctor Taylor, of Johns Hopkins, showed conclusively some years ago that unless the patients were examined by a surgeon at the follow-up clinic no accurate statistics of recurrence could be obtained. Doctor Taylor wrote a postal card to those who could not appear at the follow-up clinic. Of those patients who were re-examined by the surgeon there was a recurrence of 8.4 per cent. whereas in those cases which reported by postal card only 3.4 per cent. stated that they had a recurrence, which proves conclusively that the patient himself is not always cognizant of the presence of the recurrence.

In the statistics of Erdman in the service of Dr. Eugene Pool the percentage of recurrence in 1,000 cases was 7.5 per cent. Of 665 cases of operation for oblique hernia there was 3.15 per cent. recurrence, while of 318 for direct there was a recurrence of 16.51 per cent. Erdman points out that practically 50 per cent. of all recurrences were observed within six months after operation. This has been Doctor Owens' experience.

Cases for herniorrhaphy should be carefully selected and the older the patient the greater the chance of recurrence. Fifty per cent. of recurrences are those who are operated upon after forty years of age. Recurrence is more apt in the obese. He attempts first to reduce by diet these obese patients. Those who are inclined to have the so-called Pool bulge are apt to have recurrence after operation.

Of course in children the operation is simple. Usually tying off the sac suffices. With oblique hernia in early adult life a Bassini operation will usually suffice but in those cases which have a large oblique hernia or a direct hernia with a poor conjoined tendon he now, after tying off the sac and transplanting the sac after the method of Barker, repairs the floor of the canal by using the transplanted sheath of the rectus muscle after the method of Halsted. He also transplants the fascia of the external oblique beneath the cord, suturing this to Poupart's ligament, not to the thin, frayed, free margin but to the shelving margin. He has seen only one case in which he regretted transplantation of the cord superficially. That case, a recent one, developed atrophy of the testicle, which had to be removed. He had for about three years performed the operation as suggested by Doctor Stettin but has discontinued this procedure.

Following operation in a child it is necessary to keep the child bedridden only for about eight to ten days; in an adult operated upon for a large oblique or a direct hernia he keeps the patient in bed for at least fifteen days and for a bilateral hernia for eighteen to twenty-one days. In the case of policemen and firemen the men are allowed to do light duty after having been discharged from the hospital for one month but are not allowed to return to active duty for a period of three months.

The frequency of recurrence above the internal ring has been mentioned. In order to minimize the danger of recurrence in this location he always places at least one suture to close snugly the internal ring above the cord.

BRIEF COMMUNICATIONS

HÆMOSTASIS DURING SPLENECTOMY

SPLENECTOMY may be a very simple operation or it may be a very difficult one. When the splenic pedicle is long and the spleen free, the operation is usually quite easy. When there is a long-standing disease of the spleen with great enlargement and adhesions accompanied by a diseased liver with its resulting pathology, serious difficulties may be offered.

In a well-developed case of Banti's disease and in other conditions, vessels of the splenic pedicle may be surprisingly large, tortuous and short; the greater curvature of the stomach, the tail of the pancreas and the splenic hilus being in close approximation. When this condition obtains, the ordinary methods of clamping and ligation or ligation by use of the ligature carrier do not work out well. The vessels are so short and so easily damaged that neither method is free from the danger of troublesome hæmorrhage, not to mention the possibilities of damage to the stomach and pancreas.

In traumatic rupture of the normal spleen, the operative procedure is usually not difficult, but rupture, traumatic or spontaneous, of a much enlarged, diseased and adherent spleen, may tax the surgeon considerably. In a case of well-advanced Banti's disease with very large tortuous vessels in the splenic pedicle and in a second case of the same disease with spontaneous rupture of a spleen weighing 1700 Gm., the writer used a method of dealing with the pedicle which seemed safe and greatly simplified the operation.

After the spleen is freed from the adhesions to its bed, is lifted and a large hot pack placed in its fossa, the pedicle is clamped with a rubber-shod intestinal clamp, far away from the spleen. If the pedicle is short, this means, in all likelihood, that the greater curvature of the stomach and part of the pancreas will be included. This gives complete control of hæmorrhage, the tail of the pancreas can be freed from the splenic hilus, if this is necessary, and the vessels in the pedicle ligated at leisure in the manner selected. There is no reason to fear damage to the stomach by the rubber-shod clamp and its application for the few minutes necessary does not damage the pancreas.

When the vasa brevia are tied individually and quite close to the greater curvature of the stomach, one feels some fear that a severe vomiting attack might push off a ligature, particularly if catgut is used. Greater security of these vessels is obtained by burying each ligated vessel with a pursestring of silk taken in the stomach border. This is a minor point in the operative technic but possibly a secondary hæmorrhage may be prevented by using it.

WALTER D. WISE, M.D.
of Baltimore, Md.

A BONE CLAMP APPARATUS FOR THE OPEN REDUCTION OF FRACTURES

THE instrument herein described was designed for the purpose of giving the operator absolute control of the mechanical forces involved in the open reduction of fractures of long bones. With the ability to manipulate the fragments at will, irrespective of contracted muscles and other resisting forces, the open reduction of fractures becomes an operation of precision which can be accomplished in a short time with a minimum of soft tissue trauma. Without perfect control over the forces interfering with reduction, the operation more often than not becomes a bungling procedure with assistants pulling and hauling on the injured limb while the operator tries to pry the fragments into place. Such inaccurate procedures are bound to be accompanied by destructive trauma to soft tissues, danger to important vessels and nerves and increased danger of infection.

The fundamental mechanical requirements for a bone-setting instrument may be summarized as follows:

First: it must be able to grasp the bone fragments so firmly that there is no danger of slipping of the instrument on the fragments during the manipulation of the fragments.

Second: it must place at the command of the operator controlled mechanical forces equal to any resistances he may encounter in the reduction.

Third: the instrument must be so designed as to provide for utmost flexibility of movements in all directions. The apparatus herein described meets all of the above requirements.

In describing this clamp to aid in the open reduction of fractures, I do not want to be understood to advocate the use of bone plates or other forms of buried foreign-body retention apparatus. I resort to open reduction only when I am unable to get satisfactory reduction by closed methods. Open reductions I practically never plate. If the fragments are difficult to hold in place, I usually rely on the simple procedure of forcing the end of one fragment into the marrow cavity of the other.

E. MACD. STANTON, M.D.
Schenectady, N. Y.

EXCESSIVE CALCIFICATION IN A CASE OF CHRONIC TUBERCULOSIS

THE following case of tuberculosis of the spine and lymphatic glands appears to be of interest on account of the marked and widespread calcification.

CASE I.—R. S., aged thirty-five years, an engineer, was admitted to the Central Middlesex County Hospital August 27, 1932, suffering from a painful swelling of the right axilla.

The patient gave a history of having suffered from enlargement of the cervical glands since 1909. In May, 1915, he sustained an injury to the spine in a motor accident, and

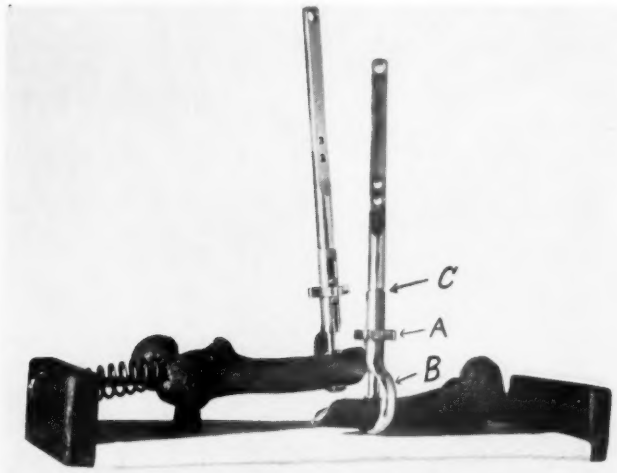

FIG. 1 shows the jaws attached to the two fragments of an over-riding fracture. The vise-like grasp of the jaw is controlled by the winged nut (A) which forces the pin (B) against the bone. The jaw is designed to grasp bones from 5/8 to 1 5/8 inch in diameter, a range which will include all long bones from the largest femur to a radius. The jaw handles pivot on their long axis at (C) so that no matter what the positions of the jaws may be when applied to the bones, the jaw handles can be readily adjusted to fit into the controlling apparatus. The fixed portion of the jaw is so designed that it can be used as a blunt dissector and simply slid around a bone without freeing the tissues above or below the clamp.

FIG. 2 shows the controlling apparatus attached to the jaw handles with the bone fragments still in their original, unreduced position. When applied in the position shown in this illustration, the first part of the extension is obtained by a rotating movement of the controlling handle followed by use of the screw extension.

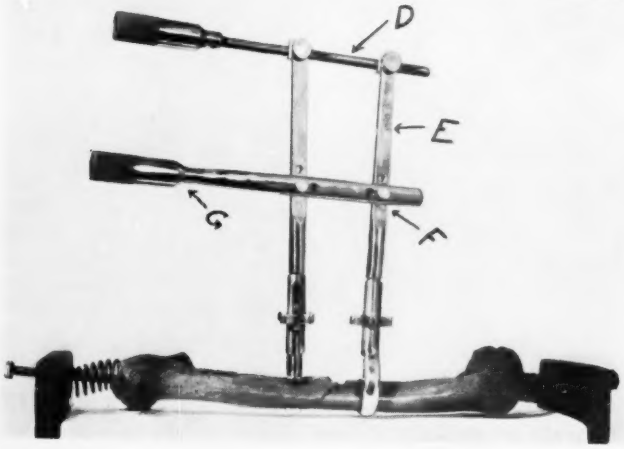

FIG. 3 shows the apparatus in position with the fracture reduced. Extension is obtained by means of the right and left threaded screw (D) acting on the jaw handles (E) fulcrumed at the points (F) on the adjusting handle (G). This mechanism allows steadily applied extension which can be made as slowly and deliberately as may be necessary to allow for the gradual stretching of contracted muscles and other tissues. The operator has at his command power for producing extension far beyond any that he will actually need but the amount of extension is at all times controllable to a minute fraction of an inch.

in October of the same year developed paraplegia, which was shown by radiography to be associated with spinal caries. Postural treatment was given for three periods of six months each.

In 1918 a left psoas abscess developed, and this was soon followed by an abscess in the left lumbar region.

In 1928 the right leg became swollen, and a vein on the same side of the abdomen was noticed to be prominent; both these conditions were at first relieved by lying down.

Since the onset of the disease the patient has had thirteen operations performed at varying intervals for abscesses developing in the neck, axillæ and groins. He had also received several courses of tuberculin treatment.

Fig. 1.—Anastomotic vein coursing upwards on the right side of the abdomen.

There was no family history of tuberculosis.

The general appearance of the man was good. There was a large abscess in the right axilla, beneath which firm glands could be palpated. In each axilla, on both sides of the neck, and in each groin numerous glands could be felt, many being stony hard. In the right side of the abdomen large masses—assumed to be glandular in origin—could be palpated.

Healed scars were present in both loins, in the left groin, in each axilla, and below each nipple. In the right axilla were three sinuses, each having a bluish skin margin. The spine showed a thoracolumbar kyphosis.

Extending upwards on the right side of the abdomen was a large tortuous vein which passed from the groin to the pectoral region. (Fig. 1.) This vein filled from below upwards, and became more distended on deep expiration. There was no œdema of either leg, and no enlargement of the liver or spleen was detected.

No abnormalities were found in the heart, or in the urinary or nervous systems. Slight bronchitis was present, but the sputum contained no tubercle bacilli. The Wassermann reaction was negative in the blood, and the blood count was within normal limits. No tubercle bacilli were found in the fæces.

Radiographical Examination.—In the neck and axilla many calcified glands were clearly seen, while in the lower thoracic and lumbar spine there was evidence of old standing tuberculosis; fusion of the anterior surfaces of vertebræ could be seen as well as many areas suggesting calcification of glands or abscess walls.

This case is presented on account of several unusual features:

(1) Evidence of excessive and widespread calcification—best seen in the accompanying radiograms. There was a notable absence of glandular enlargements in the chest, in spite of marked involvement of the cervical and abdominal glands.

FIG. 2.—Calcification of lymphatic glands on each side of neck and in the axillæ.

FIG. 3.—Calcification of abdomino-pelvic lymphatic glands and walls of abscess cavities. In the lateral view an area of new bone formation can be seen.

FIG. 4.—Calcification of abdomino-pelvic lymphatic glands and walls of abscess cavities. In the lateral view an area of new bone formation can be seen.

(2) The presence of an anastomotic vein coursing superficially upwards on the abdominal wall. (Figs. 2, 3 and 4.) On account of the large masses felt in the right side of the abdomen, one is led to assume that this was caused by pressure on the inferior vena cava.

(3) The presence of new bone formation as shown by the fusion of certain vertebræ.

(4) The tuberculous infection appeared to be chiefly localized to bones and glands, with only a limited spread to adjacent structures, *e.g.*, skin.

(5) The patient, though suffering from long-standing tuberculosis, is in good health, probably because of the limitation of the disease by calcifying processes. Despite numerous abscesses and discharging sinuses at different times, no evidence of amyloid disease was elicited.

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In the April issue of the ANNALS OF SURGERY attention is called to page 605 of his statement that "mupercaine should not be boiled without increasing its stoxtoicity." The freely boiling of the mupercaine is correct.

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